NOT ALL TARGETS ARE CREATED EQUAL:
DEVELOPING EFFECTIVE AIR-TO-GROUND
TARGET IDENTIFICATION CRITERIA

A thesis presented to the Faculty of the U.S. Army
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MASTER OF MILITARY ART AND SCIENCE

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This thesis investigates how an air component commander integrates air-to-ground target identification criteria into combat air operations. The analytical methodology of the thesis begins by developing common attributes of effective criteria. It then uses these common attributes as a framework for comparing two different paradigms for articulating rules of engagement in this area. The first is the "positive identification" approach, indicative of recent air operations and exercises. The second paradigm, developed by the author, is one in which a commander communicates weapons system-specific criteria for each tasked target. The author has drawn upon official doctrine, personal interviews, a survey, and unclassified written documents as source material for the thesis.

The thesis concludes that there should be a fundamental shift in how air commanders integrate air-to-ground target identification criteria into combat air operations. Communicating weapons system-specific criteria for each tasked target is more advantageous than using an over-arching criterion, such as "positive identification." Target-specific criteria allow a tasking commander to communicate and manage risk better based on such factors as mission priority, capabilities of delivery platforms, and the potential for collateral damage or fratricide. Furthermore, the existing air tasking order process, with minor modifications, can effectively support this approach.

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ABSTRACT

NOT ALL TARGETS ARE CREATED EQUAL: DEVELOPING EFFECTIVE AIR-TO-GROUND TARGET IDENTIFICATION CRITERIA by Major Michael D. Rothstein, USAF, 98 pages.

This thesis investigates how an air component commander integrates air-to-ground target identification criteria into combat air operations.

The analytical methodology of the thesis begins by developing common attributes of effective criteria. It then uses these common attributes as a framework for comparing two different paradigms for articulating rules of engagement in this area. The first is the "positive identification" approach, indicative of recent air operations and exercises. The second paradigm, developed by the author, is one in which a commander communicates weapons system-specific criteria for each tasked target.

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LIST OF ABBREVIATIONS

AFDD	Air Force Doctrine Document
ATO	Air Tasking Order
CGSC	Command and General Staff College
CARL	Combined Arms Research Library
CAS	Close Air Support
DMPI	Desired Mean Point of Impact
GPS	Global Positioning System
ID	Identification
IR	Infrared
JFACC	Joint Force Air Component Commander
ROE	Rules of Engagement
SPINS	Special Instructions
USAF	United States Air Force

CHAPTER 1

INTRODUCTION

Unlike men, not all air-to-ground targets are created equal. In order to achieve the desired goals of an air campaign, certain targets are worth committing more resources or accepting more risk to destroy than others are. Consequently, the combat air force commander faces two ongoing challenges while executing the force application portion of his air operation. He must appropriately allocate available air assets against a prioritized set of objectives, as well as determine when and where he will accept risk. The air component commander's degree of success is directly related to how well he does these two things. He cannot afford to squander his resources on periphery objectives, or to be risk averse against decisive targets. This is, perhaps, the essence of the airman's operational art.

The concept of "centralized control and decentralized execution" empowers this art. Airmen, recognizing airpower's flexibility, versatility, and responsiveness, support this concept as a basic tenet of air operations. Within this framework of operational employment, a planning methodology has developed through which an air commander can command and communicate his strategy to those who execute it. The joint force air component commander (JFACC) maintains centralized control, with the help of his planning staff, by analyzing the joint force commander's campaign plan, developing prioritized target sets in support of it and by allocating air resources against these targets. Targets are assigned appropriate resources based on their particular priority and on the amount of risk the commander is willing to accept. The JFACC then communicates his plan to those executing it through the joint air operations plan and the daily air tasking

order (ATO). Thus, at the centralized command level, the JFACC manages risk in a macro sense.

Unfortunately, while the ATO process effectively prioritizes resources and imparts necessary coordination details to the decentralized execution level, it does not have an architecture that effectively communicates the commander's intent for different areas of risk management. For example, a critical area of focus in the JFACC's risk strategy concerns the confidence his airmen should have, as they approach their weapon release point, that they are engaging the correct surface target. Traditionally, the ATO and associated instructions provide little guidance to airmen short of generalized air-to-ground target identification rules of engagement (ROE). These ROE apply to all targets, regardless of their particular priority or other defining characteristics. Thus, at the micro level, because there is no methodology to communicate the tasking commander's specific intent with regard to particular targets, risk management defaults to individual airmen and crews. Can such a methodology be developed? Given that all targets are not created equal, would it enhance the effectiveness of an air campaign?

This thesis addresses these questions. Specifically, the purpose of this thesis is to investigate how an air commander can effectively integrate air-to-ground target identification (ID) criteria into air-to-surface combat operations. This particular chapter begins by providing some background as to the nature of the topic. From there it lays out the primary research question the thesis addresses, why the author was motivated to write on the topic, and the applicability of the thesis. Subordinate questions are discussed next. Following that, the author notes assumptions he has made, explains delimits he imposed on the research, and defines key terms used throughout the paper. The chapter concludes

with a discussion on how air-to-ground target ID criteria serve as a risk management tool for the commander.

Background

Every time a pilot or aircrew member goes to drop a bomb, he must ask himself whether he is confident enough that he is dropping on the correct target. If he decides he has not reached a confidence level high enough to warrant releasing his bombs, he selects an alternate course of action. For instance, he might make a second pass at the target, proceed to a backup target, or take the bombs back to his base. If, on the other hand, he decides he is confident enough, he releases his munitions. At first glance, the decision to drop the bombs seems rather straightforward. However, in practice, the physical difficulties of identifying the target coupled with the judgment of what constitutes "confident enough" create significant challenges for the aviator.

The very nature of flying modern, high-performance aircraft poses unique challenges in identifying targets. First, the aircraft is moving at hundreds of miles per hour. This means that the time available to identify the target may be limited to a matter of seconds or less. This is especially true during low-altitude attacks where the pilot's time to acquire and identify the target is extremely limited. Another physical limitation the operator faces is that he may be using sensors other than his eyes to acquire the target. Sensors usually provide a different visual scene, or view of the world, than what the human eye is used to seeing. Interpreting images captured by such systems as radar, infrared (IR) sensors, and night vision goggles is very difficult. Even when aviators are trained to do this, the task is still not easy, especially when given a limited amount of time and other airborne duties. To make the challenge more formidable, the video image

displaying some of these sensors is often very small--to save precious space in the cockpit. The sensor display in the F-16, for example, measures a mere four inches by four inches.

Another important factor is the range from the target that pilots and aircrew employ weapons. Many of today's bombs can be dropped outside of five miles from the target, with some having ranges well beyond twenty miles. Sensors often magnify the image of the target area, but sensor magnification technology has not kept pace with the technology that supports standoff. The result can be a very small apparent target size for many targets when approaching release range. The smaller the apparent target size, the more difficult it is to identify. One last physical limitation of note is that the enemy may not be cooperative in wanting to be identified as a target. He may use camouflage and concealment to exacerbate the target identification problem even more. All of the physical limitations listed above create challenges for airmen to identify targets.

Tactics and technology have evolved to provide aviators the means to put ordnance on target without having to see it. A number of forces have spurred this evolution including the desire to stand off from enemy defenses and overcome difficulties acquiring and identifying the target. For instance, the next generation of bombs, such as the Joint Defense Attack Munition and the Joint Standoff Weapon, use inertial guidance, aided by the Global Positioning System (GPS) satellites, to find the target. In other words, they home in on a specific coordinate that the pilot programs into the bomb's memory via an aircraft interface. Using this type of weapon, the pilot can fly to a release window, drop the bomb, and effectively destroy the target without ever acquiring or

identifying it. These weapons guide to the target unconstrained by clouds, smoke, haze, or lighting conditions.

Even without using the new, sophisticated, guided weapons, aviators can drop accurate bombs without identifying the target. Aircraft with ground-mapping radars, such as the B-1B Lancer, F-15E Strike Eagle, and the F-16C Fighting Falcon, can use their radar to find the target and aim their weapons. When tasked against targets that do not show up on radar, the pilot or crewmember has the option to aim at a radar-significant offset aimpoint. When operating in this mode, the aircraft's computer adjusts the bombing solution from the aimpoint to the target by way of a programmed distance and bearing. Thus, the airman aims at the offset point, but the bombs drop on the "no-show" target. In this case, the airman still has high confidence he is bombing the correct target. It is important to note, though, that the bomb-dropper has, in literal terms, met no standard whatsoever of target identification. The aviator has only identified the offset aimpoint. Airmen can also use other sensors, such as a forward-looking infrared systems, to the same effect.

Because of the excellent accuracy of many aircraft navigation systems, it is also possible to drop a blind bomb and destroy a target using unguided, free-fall munitions. By a blind bomb, the author is referring to a situation where the pilot does not identify the target or an offset, but instead relies on the accuracy of his navigation system and fire control computer to aim the bombs at known target coordinates. The techniques explained above illustrate how it may be possible to destroy a target effectively without having to identify it.

This evolution of tactics and technology has opened new doors for airpower. In previous conflicts, airpower's most worthy adversary was often Mother Nature. Poor weather caused many missions to be cancelled or postponed because the aviators would not have had any way to acquire and identify the target. Now, there is great potential to use airpower effectively in conditions that were previously unsuitable. As airpower becomes a true all-weather force, commanders must adjust the guidance they give their subordinates, to account for new capabilities and limitations.

Commanders of air-to-ground operations usually establish criteria that define a minimum acceptable standard of confidence of bombing the right target before aviators release their weapons. When given a name, this standard has historically been referred to as air-to-ground target ID criteria. Because of this, there exists a general perception that identifying the target is an end unto itself, rather than a means to an end. However, it is more advantageous to consider target identification as a means to achieving the more important goal of making sure the aviator aims his weapons at the correct target. The two concepts are linked, of course, because, if the former happens, the latter will also likely occur. If a pilot can identify the correct target and can tell where he is aiming (which aircraft systems are designed to do), he can subsequently aim at the correct target. However, the examples in the paragraphs above point out that it is quite possible, in certain situations, to have a high confidence of hitting the target without having to identify it. Hence, there exists a disconnect when the name given to the measure of standard is target "identification" criteria, yet identifying the target is not always required to get the job done.

Using target "ID" criteria may not be the best choice of words when the more important goal is to correlate that the pilot is aiming at the right target. The danger in the "ID" construct is that it potentially limits thinking to those sets of attacks that allow the pilot to identify the target. A better paradigm for modern airpower operates in terms of air-to-ground target "correlation" criteria. In this construct, the subset of identifying the target is one of several ways to correlate that the aviator has met a prescribed confidence level of engaging the correct target. Figure 1 illustrates the concept.

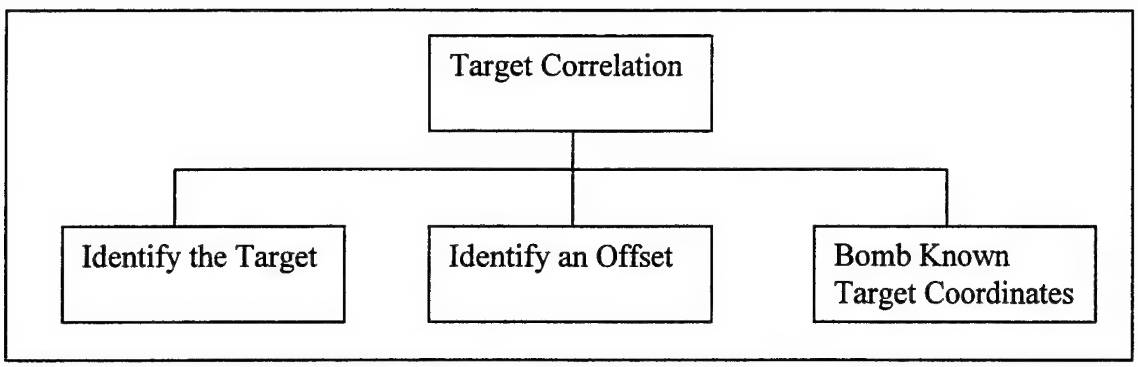

Figure 1. Target Correlation

Although the airman may arrive at target correlation through various approaches, there are varying degrees of confidence between and within each subset.

Using an offset aimpoint, for example, does not produce the same amount of confidence as actually identifying the target. Suppose a target assigned to an F-15E crew is a surface-to-air missile site. The primary plan is to acquire the target visually, identify it, and drop the weapons using the bombing sight in the pilot's heads-up display. If an undercast weather deck obscures the target, the backup plan calls for the weapons

system operator to use the ground map radar to aim on an offset aimpoint. The day of the mission, the weather in the target area is good. The pilot maneuvers the F-15E into visual attack parameters, acquires the target area, and discovers that the missile site is gone. The enemy has packed it up and moved it somewhere else. They abort the pass, dropping their bombs on their alternate target. Had the weather forced the crew into the backup attack, they would have dropped their bombs where the surface-to-air missile site used to be. This would have happened because they would have successfully identified and aimed at the offset, but would not have known that the target was not there. One can extrapolate this example into a general conclusion. Against potentially mobile targets, using an offset aimpoint does not provide the same confidence level as identifying the target. As targets become more static, there is less of a difference in confidence level between using an offset and identifying the target.

Bombing a target based only on coordinates and the aircraft's weapons computer provides less confidence than using an offset. When using an offset, the airman is still relying on the target coordinates and the aircraft's computer, but he is also correlating the veracity of his aircraft's navigation system to a known point on the ground. The offset correlation method should alert the pilot to a navigation system that is in error, or perhaps a target coordinate that was mistyped into the computer. If there is a sizable target coordinate error, then the pilot will likely recognize it based on his general situational awareness. However, if the error is relatively small, the pilot is less likely to perceive the error without correlating the target to some fixed point on the ground.

It is important not to confuse a method that provides more correlation confidence as being the same as one that provides the most accuracy. Using the aircraft's radar to

acquire and identify a target results in a higher degree of correlation confidence than dropping on known target coordinates (without correlating the navigation system to a fixed ground position). This is because the radar picture confirms that the target is where his premission planning said it was. However, once the aviator is confident he has the correct target, his most accurate delivery may be to aim using his GPS-aided navigation system, rather than aim using the radar returns. Of course, this decision depends on the comparative qualities of the radar and navigation systems of the aircraft.

Even when trying to identify the target, the aviator goes through various degrees of confidence. Depending on what he can see, his confidence, in the end, may be more or less than the confidence resulting from using one of the other approaches. Physical limitations force the airman to work within what this author refers to as a continuum of confidence. Somewhere down that continuum, he passes a point where he decides that he has met a standard of confidence that makes it permissible to drop his bombs. Before he begins his attack, he has zero confidence that he has identified the target. As he proceeds, he gathers more data and his confidence that he has correctly identified the target increases. At some point, he might even determine that he feels 100 percent sure that he has correctly identified the target. Consider the aircrew member tasked to bomb the Pentagon. Because that target is particularly distinctive, he will likely reach a point before he releases his munitions at which he feels one hundred percent confident he has the correct target in his sights. However, in other situations, it may be impractical to reach that 100 percent determination. This author would argue that a pilot, using an IR sensor from six miles away, could not be 100 percent confident of identifying an enemy tank as a target. He may be almost sure, and his situational awareness may lead him to

perceive that the image in his display is the correct target, but he could not pick it out of an "aerial lineup," per se.

Research Question

At what point down the continuum of confidence does it become acceptable to the commander for an airman to drop his bombs? It is in a framework of trying to articulate an answer to this question that commanders should develop air-to-ground target correlation criteria. The primary research question of this thesis is, How should a joint force air component commander effectively integrate air-to-ground target correlation criteria into combat air operations?

The desire to explore an answer to this question stems from a personal dissatisfaction with previous air-to-ground target ID criteria to which the author has been exposed as a fighter pilot in the US Air Force (USAF). During eight years as an operational F-16 pilot, the author has had extensive experience with the surface attack mission and has developed a thorough understanding of the ATO process. Working in a joint air operations center plans division at a joint task force headquarters, the author has seen the challenges of attempting to communicate a commander's intent on this subject to subordinate units. Conversely, at the unit level, this writer has been frustrated in trying to get clear guidance from the chain of command. It is from these experiences that the research question was born.

Answering the research question is important because it will help an air commander and his staff more effectively control the use of force. Effective air-to-ground correlation criteria will help a commander communicate his intent for the operation and establish limits on the amount of risk he wants an operator to accept when

balancing mission accomplishment against target correlation. Additionally, this thesis could assist the combat Air Forces within the U.S. military to develop a common framework for executing air-to-ground target correlation criteria. If a common frame of reference for articulating correlation criteria can be instilled into USAF and joint doctrine, then commanders, their planning staffs, and combat units will be able to train better for the tomorrow's conflict. The military is much more likely to be successful executing a plan or process that it has practiced and polished, rather than reinventing a different framework for each operation. This is especially important when commanders publish orders to remote locations with little or no ability to discuss the intent for a particular mission. Thus, the thesis will attempt to develop a process that is consistent enough for use throughout the combat Air Forces, yet flexible enough to give commanders the tools to react to changing political and military environments.

Subordinate Research Questions

Full development of the primary research question requires exploration of three subordinate questions along the way. The subordinate questions lay the groundwork for addressing the primary question. They help the research by bringing focus to parts of the solution that will make up the whole.

One of the subordinate questions must be, What common attributes should effective air-to-ground target correlation criteria share? Answering this question is central to this thesis because it establishes a foundation for evaluating different frameworks for air-to-ground target correlation criteria. Additionally, it helps to define the primary research question by developing measures of merit for effective criteria.

Is the current paradigm for articulating air-to-ground target correlation (or identification) criteria effective? This is the second subordinate research question. Addressing this question helps answer the primary question by examining the model that is already in place. A critical analysis of the current paradigm should offer useful insight to any strengths and weaknesses of the model under which aviators currently operate.

The third subordinate question is, Should the commander tailor criteria to individual missions and targets, and if so, what framework might allow the commander to do this effectively? Addressing this question supports the primary research question in that different answers will lead to very different processes as to how the commander integrates criteria into the operation. If the answer to the question is no, criteria must be overarching enough to suffice for the entire operation. On the other hand, an affirmative response to this subordinate question must result in an effective, efficient system that allows the commander to decide upon and communicate correlation criteria for each specific target. If the criteria is too complicated and detailed, a commander may make effective execution excessively difficult. On the other hand, overly vague guidance may result in the misapplication of the commander's intent. How much is too much, or too little guidance, and what is the proper balance? The thesis will discuss each of the subordinate questions as a means of getting at the primary research question. As the next sections address, several assumptions and delimitations will frame those discussions.

Assumptions

In order to help focus the research, the thesis was built on three assumptions. The first was that, if an airman is attacking an air-to-ground target, it is legal, valid, and falls within the scope of the ROE. There are other facets of the ROE that may influence a

person's decision to drop a bomb on a particular target besides identifying it. These might include whether the target was in a protected status, such as a hospital or significant cultural site. Another potential decision point might be whether the pilot met established self-defense criteria for dropping bombs in a peace enforcement operation. For the purposes of the thesis, these types of ROE questions were not an issue.

A second assumption of the thesis concerned the model that the paper borrowed to describe how a commander publishes ROE, other procedures and guidance, and mission orders. While the thesis worked from the model currently in place in Southwest Asia, the assumption was, conceptually, this model is applicable to other theaters of operations. An upcoming paragraph describes that framework in detail.

The final assumptions the author used in designing this thesis is that the JFACC retains the authority to establish air-to-ground target correlation criteria. Conceivably, someone higher in the chain of command, such as the joint force commander or the National Command Authority, could weigh in on this subject and prescribe these criteria. However, this is not very likely. Whatever process or criteria the JFACC develops may have to be approved by higher authority, but this thesis assumes that the JFACC maintains the primary responsibility for integrating air-to-ground correlation criteria into an air operation. It is also worthwhile to point out here that whatever procedures the JFACC published for close air support missions would need to be coordinated and approved by the joint force land component commander. Besides three assumptions, there were also two delimitations that affected the research.

Delimitations

The biggest delimitation of the thesis is that it is unclassified. This prevented inclusion of specific criteria from any ongoing military operations as references. Excluding classified material affected the breadth of reportable research in the thesis, but it did not adversely impact the ability to answer the research question. Examples of air-to-ground target ID criteria from previous air operations and various exercises were available at the unclassified level. The purpose of keeping the thesis unclassified is to make the product more accessible.

Another delimit was to use only one type of command structure as a basis for developing answers to the research question. The thesis based the command structure on current joint doctrine. In this command relationship, a joint force commander, responsible for the entire theater of operations, works directly for the National Command Authority. One of the joint force commander's direct subordinates is the JFACC. With few exceptions, he is responsible for the planning and execution of the air campaign within a given theater. Thus, the JFACC is responsible for publishing aerial rules of engagement and special instructions (SPINS) to subordinate units (Department of Defense 1994a). Other types of potential command structures might lead to different methods or responsibilities for developing and publishing this type of guidance. Examples of these include multinational coalitions under the command of an American or foreign officer, or single service commands. The paper will not explore these possibilities to keep the research focused. Since much of the thesis looks at how to modify an existing process, it is essential to be consistent with the baseline process

addressed. The next paragraphs introduce some of the key terms used in the process by which the JFACC tasks and gives guidance to subordinate units.

Operational Definitions

One term the author has coined for use throughout this thesis is correlation risk. The author has defined correlation risk as: the potential that an airman is engaging the incorrect surface target. The greater the amount of correlation risk, the higher the likelihood that an aviator will potentially drop on the wrong target. The amount of correlation risk assumed through various methods of weapons delivery will be a central topic throughout the thesis. There is an inverse relationship between the stringency of a given set of air-to-ground target correlation criteria and the maximum amount of correlation risk the commander wants an airman to assume.

For the purpose of this thesis, this author will define air-to-ground target correlation criteria as: directives issued by competent authority establishing standards for when an airman may release air-to-ground munitions based on his confidence he is engaging the correct target. Some sort of air-to-ground target ID criteria has historically been part of the ROE for previous air operations, despite no formal definition or requirement published in joint or Air Force doctrine. By extension, the author will consider target correlation criteria to be a part of the ROE also. As discussed earlier, this paper assumes the JFACC will be the commander, or competent authority, that is responsible for articulating air-to-ground correlation criteria.

Joint Pub 1-02, *DoD Dictionary of Military and Associated Terms*, defines ROE as: "Directives issued by competent military authority which delineate the circumstances and limitations under which United States forces will initiate and/or continue engagement

with other forces encountered" (Department of Defense 1989, 373). Another way to describe this to the tactical aviator is: what can be shot and when (Owen 1998, 10-3)? Throughout the thesis, "ROE" will refer to command guidance about the appropriate use of force regardless of the echelon that promulgates it. Joint doctrine states that the joint force commander is responsible for creating ROE (approved by the National Command Authority) for his geographic area of responsibility (Department of Defense 1995a). Furthermore, ROE imposed by any subordinate commander, such as the JFACC, can be no less restrictive, and should be consistent with the intent of higher echelons of command (Department of Defense 1994a).

An aviator will find guidance on the air-to-ground ROE for a given operation from four formal sources. They are, the joint air operations plan, the SPINS, the air tasking order, and command briefings. Ideally, these four sources are consistent so there is no conflicting guidance.

The joint air operations plan is the basic document that lays the foundation of how the JFACC will conduct the air campaign within a given theater (Department of Defense 1995a). It includes a section on the ROE. Because the joint air operations plan is usually only published at the beginning of the operation, the JFACC has other methods for disseminating command guidance during the course of an operation.

The JFACC publishes periodic special instructions as a method to communicate with tactical units. In Operation SOUTHERN WATCH there are monthly, weekly, and daily SPINS. The SPINS contain detailed guidance on the ROE not found in the joint air operations plan. The ROE are just a small part of the information that the commander communicates through the SPINS process. For instance, SPINS might include:

frequency assignments, coordination procedures for combat search and rescue operations, code-word listings, and a myriad of other instructions necessary to execute air operations. The information that needs to change more often will come out in the daily SPINS, while the more relatively permanent information will be in the monthly SPINS.

The ATO is the daily document that tasks subordinate units to specific missions and targets. The JFACC times the publication of the ATO so it arrives in the hands of executing units the afternoon before the execution day. This allows time for units to plan and coordinate the mission. Mission specific remarks in the ATO could conceivably contain ROE guidance for a particular mission or target. This, in fact, was the case during Operation DELIBERATE FORCE in Bosnia (Godier 1998).

A final source of air-to-ground ROE is command briefings. Briefings from headquarters on ROE are not a doctrinal or regulatory requirement. Nevertheless, most commanders have elected to use this technique in recent years. It is likely that someone thoroughly familiar with the subject will brief airmen who are new to an operation on the rules of engagement. This brief can clarify a commander's intent, reinforce the learning of ROE, and explain how the commander wants his subordinates to apply the ROE in the air. With an understanding of where airmen get their guidance, it is instructive to take a step back and look at why commanders promulgate this these procedures in the first place and what factors influence the policy they form.

Factors Influencing Development of Air-to-Ground Correlation Criteria

A set of air-to-ground correlation criteria is one of the tools the commander uses to communicate to his subordinates the circumstances under which he wants them to use

force or show restraint. There is no law of armed conflict stating that airmen must identify a target before dropping their bombs. The U.S. military imposes this restriction upon itself. Having some standard of target identification or correlation criteria is essentially a risk management tool. The more stringent the criteria, the less likelihood there is that an aviator will release his bombs while aiming somewhere else besides the correct target. Correlation criteria protect against the undesirable outcomes of either missing the target or dropping bombs on the wrong target. The policy maker must strike a balance, however, because the more restrictive the criteria, the more likely it is to be adverse to mission accomplishment at the tactical level.

The consequences of accepting increased risk of missing the target, or dropping on the wrong target vary with the situation. Sometimes the impact is minimal. Consider the strategic bombing campaigns of World War II, in which allied bombers sometimes attacked German cities. Suppose an aircraft was over a target area, such as Hamburg, that was somewhat obscured by clouds. If the bombardier could only marginally ID the target and had no ability to reattack, he would still likely let loose his load. If he missed his particular target, he would still meet general mission objectives, if not specific ones. Certainly, collateral damage was not an overly important issue at the time, for the objective of the bombing mission was to cause as much collateral damage as possible. Since the aircraft was already in the target area, the crew had already exposed themselves to the enemy. Therefore, aborting the pass would not lessen their risk to the threat. In fact, because of the decreased performance of the bomber with the extra weight of the bombs on board, not dropping the bombs would actually increase the potential of being shot down. Assuming no one else in the formation destroyed the bomber's target,

someone might have to come back again another day to destroy it. Of course, this would occur regardless of whether the bombardier held the bombs or potentially dropped them off target. As long as the available supply of bombs was adequate, the negative impact of accepting less stringent ID criteria was minimal in this particular situation.

In other situations, the negative impact of missing the target or dropping on the wrong target can be profound. On a close air support (CAS) mission, in which aircraft provide direct support to ground forces, the potential for fratricide is high. Either missing the target, or misidentifying the target can result in friendly casualties, as well as not accomplishing the mission. In such a scenario, it is prudent for the aviator to have a very high standard of confidence that he has correctly identified or correlated the correct target before he drops his bombs. Even in the CAS role, though, the issue is not black and white. There is a significant difference between attacking a CAS target that is a few hundred yards from the nearest friendly forces vice one that is five miles away. (Followers of the doctrinal debate over what missions fall under CAS, based on the proximity of friendly troops, might argue that the latter case is not really CAS. This author's experience is that that sortie would be flown under the mission title of CAS, and would thus be subject to guidance directed to all CAS missions.)

Air-to-ground correlation criteria negatively affect mission accomplishment at the tactical level when they cause an aviator to abort a pass that otherwise would have resulted in an attack on the correct target. They also impact negatively if they force him into a less than optimum attack profile based on exposure to the threat, accuracy, or weapons effects. There are two major downsides to not dropping his munitions for a failure to meet command-directed release criteria.

The first downside to not attacking the target is that the target remains intact. Depending on importance of the target, this can have minor-to-far-reaching effects. If a pilot were tasked against a hangar, as part of an airfield attack by a larger force, the impact of him aborting the pass because he could not comply with the correlation criteria would be minor. On the other hand, suppose the mission objective was to destroy the bridge that would otherwise allow an enemy's second echelon tank regiment to enter the ground battle. Failure to destroy the bridge and prevent reinforcements to the front might tip the tactical balance of the ground war in favor of the enemy. In this situation, overly restrictive criteria might have strategic implications. The second downside is that, if the airman does not destroy the target, someone will have to come back later to get the job done. This involves an investment of resources that will take away from other mission needs. In addition, it essentially doubles the exposure to the threat that aviators must face to destroy a given target.

In order to make an effective decision as to how much correlation risk to assume for a particular target and mission the decision maker needs to consider three principal factors. None of these factors are intrinsically more important than the others. Nor, do they encompass all the possible considerations. A policy maker must weigh each factor against the others to arrive at a judgment of what he believes to be the best course of action for a given situation. The three principal factors are:

1. Target priority
2. Physical potential for collateral damage and/or fratricide
3. Political consequences of collateral damage

Target Priority

Target priority, as alluded to on the previous page, is an important consideration for determining correlation requirements. Target priority refers to the importance of the target based on the potential consequences if it is not successfully attacked. The higher the target priority, the greater the tendency should be to assume correlation risk. All other things being equal, the commander may want the airman attacking the critical enemy early warning radar site on the first night of the war to accept more correlation risk than the one tasked against an aircraft maintenance facility. The radar site must go down that night or other missions will surely be compromised. The maintenance facility can wait another day if need be. This is not to imply that target priority is the overriding factor. The decision maker should balance it against the two other principal considerations.

Physical Potential for Collateral Damage or Fratricide

A second important factor the decision maker should consider in deciding how much correlation risk to assume is the physical potential for collateral damage and fratricide. Collateral damage is the military euphemism for destroying, damaging, injuring, or killing things or people other than the intended target. The potential for collateral damage is most directly related to the target location and what surrounds it. Targets in urban areas have a greater propensity for collateral damage than those on military installations or in remote locations. Collateral damage, or fratricide for that matter, may occur for a number of reasons. Most of these reasons are independent of the restrictions imposed by a set of correlation criteria. The next four paragraphs discuss various causes of collateral damage and whether they are influenced by correlation criteria.

Sometimes collateral damage or fratricide occurs because weapons do not always go where aviators aim them. This is true of even modern "smart" weapons. It may happen because of a malfunction in the bomb itself or one of the aiming systems that supports the delivery. Weapons may also miss their intended target because of inherent errors in their accuracy or limitations of the weapon. While the ascendancy of guided bombs has dramatically increased precision, it is not a flawless undertaking. A cloud that drifts between an aircraft and the bomb it is guiding to the target with its onboard laser will surely ruin an attack. In fact, because guided bombs actually steer to the target rather than freefall under the laws of physics, if they malfunction, they may land a significant distance away from the intended impact point. Collateral damage caused by weapons malfunction or inherent inaccuracies cannot be controlled through correlation criteria. There is no cause and effect relationship between how stringent a commander's correlation criteria are, and collateral damage due to malfunction or inaccuracy. Though, it is beyond the scope of this thesis, it is worthwhile to note that collateral damage potential of this type can be mediated by altering such strategies as weapons selection and attack profiles.

Another reason collateral damage occurs is that, although the munitions hit their target, they cause damage to surrounding structures or injure nearby civilian noncombatants. Correlation criteria cannot mitigate this cause of collateral damage either. To affect this type collateral damage potential military planners must focus on mating the appropriate weapon to the target and the attack geometry.

A third cause for collateral damage that the JFACC cannot solve using air-to-ground target correlation criteria is that aviators sometimes make errors on their bombing

attacks against a target they have correctly identified or correlated. They do everything the commander has asked of them in complying with his guidance, except hit their target. This may happen because of a lack of skill, stiff enemy defenses, or just bad luck. The result, of course, is that their munitions will hit something else besides the target--something the commander might have rather not hit.

A final cause for collateral damage and fratricide is that airmen sometimes mistakenly aim at the wrong target. Pilots or aircrew members may misidentify what they see visually, or through a sensor. Additionally, they may choose an attack profile that does not afford them the opportunity to correlate their systems to the target as well as another attack might have allowed. It is collateral damage or fratricide caused by these reasons on which this paper focuses and which the JFACC can seek to affect with air-to-ground correlation criteria. Correlation criteria cannot keep airmen from making mistakes, but they can mitigate risk directly and indirectly by influencing the tactics and weapons that aviators employ. Criteria also affect airmen's perception of the commander's intent in regards to how much correlation confidence he expects before releasing their bombs.

Political Consequences of Collateral Damage

A third factor for the policy maker to consider when coming to a decision for how much correlation risk to assume, is the political consequences of collateral damage. As the U.S. military has increased its capability in the realm of precision weapons, the political tolerance for collateral damage has decreased. During World War II, tolerance for civilian casualties was much higher. Military planners targeted population centers as

part of a strategy to break the will of the people (Builder 1994). However, this approach is not acceptable in today's political environment.

Minimizing collateral damage and civilian casualties plays a much greater role in the decision-making process. Additionally, the tolerance level for what constitutes acceptable collateral damage is lower. Because precision is possible, it is expected. The June 1993 air strike against Iraq, in retaliation of an assassination attempt on former President Bush, illustrates this trend. During an attack using thirty-three cruise missiles, eight Iraqi civilians were reportedly killed. This was considered excessive by some. In DESERT FOX, the air strikes against Iraq in December 1998, President Clinton personally deleted many of the targets Pentagon officials wanted to attack in order to achieve their military objectives. The targets were legitimate military targets, which the military would attack with precision airpower. The stated reason was that President Clinton did not want to risk injuring too many Iraqi citizens (Rather 1998). Likewise, airmen in Bosnia during the 1995 Operation DELIBERATE FORCE, bent over backwards to avoid collateral damage (Kinaan 1998).

Besides having the technological means to do so, two common links among recent air operations have contributed to the political fixation on minimizing collateral damage. The first is that the air campaigns have been part of a limited use of force, rather than a general war against a nation. Because of this, there has been no political will to let the operation spill over to where it might cause significant civilian casualties. The second commonality is that the overwhelming U.S. military superiority allows commanders to achieve their objective while still showing a great amount of restraint. For a brief period during DELIBERATE FORCE, General Michael Ryan was having his

pilots make a dry pass over certain targets before coming back to drop their bombs. While this directive was rescinded within a few days, he probably would never have ordered this if aircraft were being shot out of the sky (Owen 1998). Likewise, it is easy for President Clinton to scratch targets from the list when the Iraqis have essentially no capability to fight back. It is difficult to argue that the President exercised too much restraint when the seventy-two hour bombing campaign resulted in zero U.S. casualties.

Based on the two reasons above, the intolerance for collateral damage in recent air campaigns has likely been well founded. It would be imprudent, however, to assume that limited operations and an overwhelming U.S. military superiority will characterize all future air operations. The danger occurs if policy makers apply that same intolerance to conflicts that take on a different shape. The effects of collateral damage are easy to measure, especially in this era of global communications. Collateral damage shows up in full color on the nightly news. The media rapidly publicizes it to the American people, the country's leadership, and nations around the globe. Air commanders' decisions in this area will be scrutinized by millions of people worldwide.

Unfortunately, the effects of showing excessive restraint in target selection and the ROE are not so easy to measure. The impact of excessive restraint on the safety of airmen, the effect on the ground war, or the ability to realize military and political objectives can only be hypothesized or critiqued after the fact. Policy makers should not necessarily be guided by a steadfast intolerance of any collateral damage. Rather, they must carefully balance mission priority, the physical potential for collateral damage, and the political ramifications if it happens as they formulate ROE. The JFACC must also do this as he integrates air-to-ground correlation criteria into combat air operations.

CHAPTER 2

LITERATURE REVIEW

This chapter surveys the literature written on subjects relevant to the research topic. The first part of the chapter examines official joint and Air Force doctrine. Doctrine provides an agreed upon way for conducting military operations under normal conditions. While not binding, doctrine does represent how military institutions would like to operate. Reviewing official doctrine is important to this thesis because it will indicate how the military currently addresses the issue of air-to-ground ID criteria. Additionally, since doctrine evolves over time, examining literature that argues for changes to this area of doctrine will highlight trends and other pertinent developments. The second part of the chapter focuses on the literature written about the broader subject of rules of engagement. Some of the literature deals with the decision to use force; and if the decision maker complied with the letter and intent of the ROE. The other major issue that published literature addresses is the evolution of ROE and their relationship to meeting political and military objectives.

The most telling fact about joint and Air Force doctrine is not what is written, but rather, what is not. Joint doctrine and Air Force doctrine both discuss ROE in various manuals and instructions, but neither directly addresses the challenge of air-to-ground target identification. The only reference within Air Force doctrine to air-to-ground target ID criteria comes from Air Force Doctrine Document (AFDD) 2-1.3, *Counterland.* Even then, it only alludes to the subject rather than discussing it directly. The *Counterland* document states that aircraft employed in the close air support mission will, "normally be required to positively identify their targets to prevent fratricide" (US Department of the

Air Force 1998c, 77). Yet, nowhere does that document, or any other Air Force Doctrine Document for that matter, explain what positively identify means. AFDD 2.1, *Aerial Warfare*, which is the parent document to *Counterland*, does not even address the need for commanders to create any sort of air-to-ground target ID criteria. It does indicate, however, that the area air defense commander should integrate air-to-air ID criteria into aerial operations (US Department of the Air Force 1998a). Examining *Counterland's* sister document, *Counterair Operations*, reveals a much better discussion on target ID procedures for air-to-air targets (US Department of the Air Force 1998b). The Air Force could incorporate a similar section into the *Counterland* doctrine.

Joint doctrine is just as sketchy on the subject of air-to-ground target ID criteria. Part of this may be because no joint doctrine publication corresponds to the subject matter covered under *Aerial Warfare* or *Counterland*. Actually, the only joint doctrine manual specific to air-to-ground operations is Joint Publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support*. This is the publication to which the AFDD *Counterland* implicitly referred concerning positive identification. Even the joint CAS manual contradicts itself throughout the document. In some places, it does refer to the airman needing to positively identify the target prior to releasing weapons. However, in others it advocates techniques, such as using offset aimpoints and radar beacon bombing, to accomplish the mission (US Department of Defense 1995b). Both of these methods are at odds with positive target identification. Just like the *Counterland* doctrine, the CAS manual also fails to provide any standard for what positively identify means (US Department of Defense 1995b). Chapter 4 discusses the consequences of this lack of clarity. Even the Chairman of the Joint Chiefs of Staff Instruction 3121.01,

Standing Rules of Engagement for US Forces, does not specifically discuss the topic. Interestingly, though, that document does address air-to-air ID criteria (US Department of Defense 1994b).

An overriding theme throughout joint and Air Force doctrine is that much more attention has been given to the challenge of air-to-air target ID criteria than to air-to-ground target ID or correlation criteria. Consequently, no common framework for addressing the latter category exists. The thesis presents survey results in chapter 4 attesting to air-to-ground aviators' agreement on this point. Since military staffs have not yet integrated air-to-ground ID or correlation criteria into doctrine, the next place to turn is to literature that recommends changes in this area.

Major Ken Stefanek's thesis, "The Utilization of Inertially Guided Weapons In Performing Close Air Support," explores the challenges associated with using inertially guided weapons for CAS missions. He draws parallels between CAS using inertially guided weapons and field artillery as indirect fire support tools. In his paper, he points out the similarity between the field artilleryman firing rounds at target coordinates passed over the radio or via data link, and the aviator who does essentially the same thing in the air. Just like this author, he feels that integrating these types of weapons into the CAS framework will require a significant paradigm shift. Yet, one that is necessary if airpower is to take full advantage of the potential of inertially guided weapons. Major Stefanek recognizes that one should only use inertially guided weapons during CAS missions under certain conditions. He also understands that employing these weapons will allow the airman to engage targets without having to acquire them visually or with any other sensor. To help arrive at an effective outcome, he developed a decision matrix

delineating when a pilot could drop on a target without positive identification, pictured in figure 2. He suggests incorporating it into the joint publication on CAS, 3-09.3 (Stefanek 1998). In figure 2, the term "Troops in Contact" refers to situations where an aviator attacks targets very close to friendly forces. Joint Publication 3-09.3 defines it as inside of one kilometer from the target to the nearest friendly forces (US Department of Defense 1995b). Within the scope of a single mission and single family of weapons, Major Stefanek's paper wrestles with many of the same questions as this thesis.

Another piece of literature related to the effect of technology on air-to-ground doctrine comes from an article in the May 1998 issue of the *Marine Corps Gazette*. While it does not talk directly about any sort of ID criteria, "Reasonable Assurance--The Time Has Come," is worth mentioning. The article asserts that US Marine Corps doctrine for executing CAS must evolve to be more realistic in light of aircraft capabilities and the nature of the threat (Gual 1998). Like Major Stefanek's paper, Captain Gaul's essay points out that doctrine development has not kept pace with the characteristics of operations in the CAS arena.

The remainder of literature associated to the research topic tends to be broader in scope. There are numerous articles written on the use of force and its application to rules of engagement, but they do not directly deal with the challenge of air-to-ground target identification. They are relevant, though, because they all deal with the decision processes a commander must go through when deciding when and how he will use force. Therefore, the rest of this chapter will detail only the highlights to this body of literature.

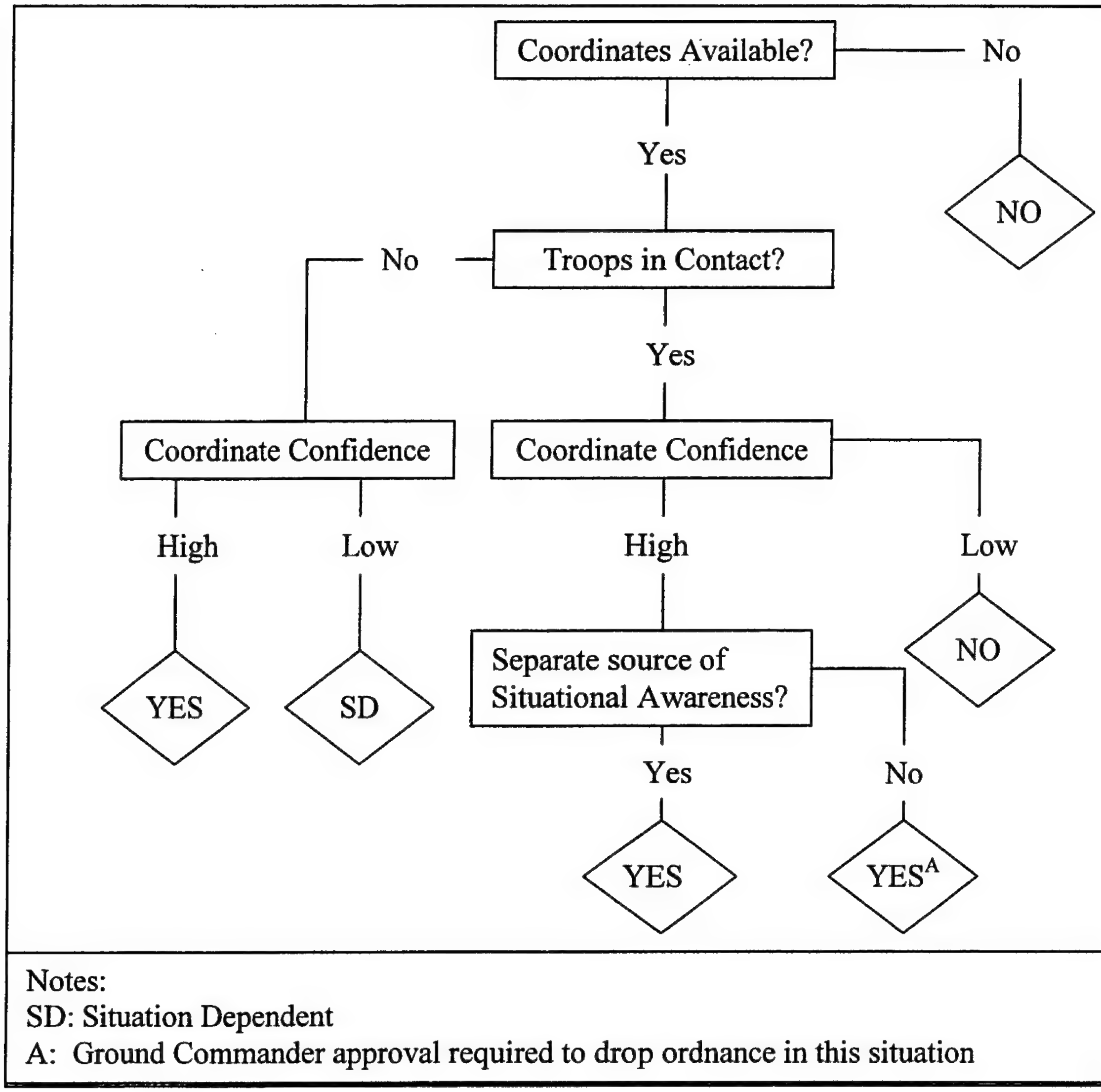

Figure 2. Using Inertially Guided Weapons for CAS

Decision Matrix (Stefanek 1998, 76)

The work on ROE most closely related to this thesis is a case study about the 1995 Balkans air campaign entitled, *DELIBERATE FORCE: A Case Study in Effective Air Campaigning*. In this study commissioned by Air University, Ronald Reed wrote an entire chapter on the development and application of the ROE for that operation. While

he does not tackle the particular subject of air-to-ground ID criteria, he does look closely at the environment in which the chain of command developed ROE and the goals they were trying to achieve. Reed's only reference to air-to-ground ID criteria is to mention that the ROE required positive target identification prior to weapons release (Owen 1998). His study provides a recent example of how ROE shaped not only the decision to use force, but also how the commander implemented the use of force once the decision was made. In doing so, he brings out several important points that will likely shape the conduct of future air campaigns and potentially impact on the formulation of air-to-ground correlation criteria.

During Operation DELIBERATE FORCE, the military placed many restrictions on its own operations. Reed contrasts the military's self-restraint to the external cuffs placed on the military by the politicians during Vietnam. He goes on to point out how the tight control that the air commander, General Ryan, placed over military operations "...will likely add to the view that, in many respects, the military is a self-regulating instrument of power (Owen 1998)." Furthermore, he states that the commander on the scene is in the best position to draft ROE. The commander is well aware of the political objectives and understands the nature of the threat conditions in the area of the operations (Owen 1998).

Another important point that Reed brings out as an implication for the future use of airpower is the growing expectation of zero collateral damage. Military planners and pilots went to great length to minimize the risk of collateral damage during Operation DELIBERATE FORCE. For the most part, they were notably successful. During a campaign that employed more than 1000 munitions, there were only two confirmed

instances of significant collateral damage--neither of which occurred because of pilot error. The ROE that led to such success did have some drawbacks though. Because of the first collateral damage incident, General Ryan changed the ROE to require a dry pass across certain targets. This unpopular decision placed pilots at increased risk to the threat and complicated mission execution. General Ryan rescinded this particular aspect of the ROE shortly thereafter (Owen 1998). This example illustrates the challenge commanders face in balancing the often-competing demands of force protection, mission accomplishment and collateral damage.

Under the unique conditions of the Bosnian air campaign, the military demonstrated that it could effectively employ airpower while minimizing the risk of collateral damage. Unfortunately, then Secretary of Defense William Perry raised the standard even higher when he inaccurately said in a speech that DELIBERATE FORCE occurred with "no damage to civilians, no collateral damage of any kind" (Owen 1998, 10-23). Reed correctly perceives that the growing expectation of zero collateral damage may lead to overly restrictive ROE as well as a sense of failure for an operation that, given more realistic expectations, should be considered a success. In summary, Ronald Reed's chapter on ROE effectively illustrates the multiple links among political objectives, military strategy, and tactical operations.

Brad Hayes' RAND study *Naval Rules of Engagement: Management Rules for Crisis* discusses the balance between maintaining a certain status quo within the political arena while giving military commanders ROE that are flexible enough to deal with potential threats. He points out that the military and political price for inaction can be as great as that of being overly aggressive. He cites the attack on the USS *Stark* by an Iraqi

F-1 Mirage warplane as an example where a conservative course of action resulted in negative consequences (Hayes 1989). The negative result in this case was that fifty-eight sailors were killed or wounded (Gross 1987). Over-aggressiveness can also have serious consequences as the shoot down of an Iranian commercial airliner by the USS *Vincennes* just fourteen months later demonstrates. The relevance of Hayes' study to this research question is that it alludes to how ROE developers must weigh the risks of inaction against the consequences of inappropriate action. This relationship will be fundamental to deriving effective ROE for air-to-ground target correlation criteria.

Reviewing the literature written on this topic leads to the conclusion that there is plenty of room for discussion and growth in this particular arena. Air force doctrine does not adequately address the subject of air-to-ground target correlation criteria, nor does joint doctrine. Therefore, chapter 5, "Conclusions and Recommendations," will offer a proposal of what could be articulated in doctrine in regards to air-to-ground target correlation criteria.

CHAPTER 3

RESEARCH METHODS

The primary research question of this thesis asks, How does a joint force air component commander effectively integrate air-to-ground target correlation criteria into air combat operations? The author relied on three different research methods to gather information he could use to help answer this question, as well as the subordinate questions listed in chapter 1. These included data from available literature, personal interviews, and a survey instrument. This chapter begins with an explanation of why the author selected each of those sources, the methodology used in gathering data, and the strengths and weaknesses of each method. The chapter concludes with a brief review of the subordinate questions and discusses the application of specific research methods to individual subordinate questions.

The purpose of seeking data from available literature was to develop a picture of what work others have already done in this field and to see how it might relate to the thesis question. The writer conducted the bulk of the literature search using resources available by way of the Combined Arms Research Library (CARL), located on Fort Leavenworth, Kansas. Those resources included published items that were physically located at the CARL, works that were available by ordering them from the publisher or via inter-library loan, and material available on the internet. As one of the preeminent military libraries in the country, the CARL contains a wealth of both classified and unclassified material on military topics. It also has a significant capability to allow a researcher to scour databases for books or articles that may be available through other sources.

To find literature relevant to the thesis, the author relied primarily on three complimentary search methods. The first method was to seek the expertise of the professional research librarians that work at the CARL. Based on information about the project the author had given them, they were able to compile lists of potentially relevant citations. The researcher's second approach was to e-mail or telephone organizations steeped in the fields of airpower doctrine, application, and theory. He contacted them and asked for help locating relevant literature. Institutions consulted included the Air Force's School of Advanced Airpower Studies, College of Aerospace Doctrine, Research and Education, the Air Force Doctrine Center, and United States Central Command Headquarters. The third method to was for the author to conduct a search using the computerized search engines from databases at the CARL, and available on the Internet, to locate potentially useful literature. For instance, via the Internet, the author accessed the research database at the Air University Library on Maxwell Air Force Base in Montgomery, Alabama. When available, the author used the abstract of potentially relevant literature to narrow the search.

One of the greatest strengths of researching the available literature was that it presented a picture of what the military has institutionally codified about the research topic. Current doctrine, policies, or regulations function as sources that can be construed as official military position. Scouring available literature also pointed the researcher to people or institutions that had expertise on the subject matter. This trail then led to further research opportunities. Another benefit of using a literature search as a research technique is that it exposed the researcher to information and perspectives that he would not likely have come across through the other methods. It also allowed him to gain the

fruits of others' labors. For example, the author found detailed information about the 1995 air operations in Bosnia through an Internet search of the Air University Library database. Someone else had already done a tremendous amount of work that the author was able to apply to this project.

While a search of available literature was a critical link in preparing this thesis, this particular research method had some inherent drawbacks. Very little is written about air-to-ground target identification criteria, especially at the official level. This made it difficult to draw conclusions about the current train of thought within the Air Force regarding the thesis question. Another weakness of this approach is that it cannot gather data about hypothetical questions unless someone else has asked and written about the same question already. Such was not the case in this instance. Since the literature review did not turn up enough pertinent data to answer the primary and subordinate questions, the author elected to supplement the research with personal interviews.

Personal interviews were an important part of the research methodology because they gave the author access to the perspectives of people in key leadership and organizational positions. The author's objective was to obtain input from two general categories of people: those who make policy and those who execute it. Policy makers are those people with experience at the command staff who are or have been involved with the development of identification criteria and other rules of engagement. Senior leaders, military lawyers specializing in operational law and commanders' staffs fall under this category. Those who execute the policy are essentially the operators of the various weapons systems, who are expected to act within the ROE.

The author conducted all of the interviews, either in person, or by telephone. The format for each of the interviews was informal. The author did not follow a prescribed questionnaire. Instead, the nature of the project was explained and the investigator allowed the conversations to consist of various questions, answers, and comments from either party. The author oriented the interviews on getting background information for the project. The interviews were also allowed to become a sounding board for various ideas related to the thesis. The goal was not to get official statements or positions from any particular person, duty title, or organization, but to accumulate any concerns and/or focus that might evolve.

The choice of people to interview was based on characteristics such as current position, specific previous experiences, or general subject matter expertise. Availability also played a significant role in the process. Some interviews drew upon a combination of some or all of the characteristics mentioned above. For example, the author interviewed Major General Timothy A. Kinaan. His current position as the commander of the Air Force Doctrine Center allowed him to share insight as to how and why doctrine exists as various levels. A previous assignment as the deputy commander of the 5th Allied Tactical Air Forces, in Vicenza, Italy, gave General Kinaan hands on experience planning and executing air strike operations in southern Europe. In that vein, he was able to relate his perspective as a senior leader and policy maker. Finally, as a veteran of the Vietnam War, he was able to relate his perspective as a fighter pilot who had to implement the ROE of that conflict.

The primary strength of the personal interview methodology was that it gave the researcher access to people with expertise in fields applicable to the thesis topic. It also

created an avenue to glimpse in current joint and Air Force perspectives that were not captured in the available literature. A relatively unique advantage of the interview technique was that, much more so than any of the other research methods, it provided a forum for two-way communication. Questions and comments returned back to the author forced him to consider new ideas, clarify his arguments, and reevaluate his positions. Similar to the literature search, personal interviews were not a strong enough source of information to stand alone as the sole research method for this project.

Two particular weaknesses of the personal interview method are notable. The first is that the author did not have access to all the people to whom he would have liked to talk. For instance, it was not practical to interview senior leaders who have served as a JFACC during combat air operations. Even when the author was able to contact people in key staff positions, they often had more pressing duties than talking with the author about this thesis. The second notable weakness of this research method was the author's inexperience as an interviewer. His failures as an interviewer resulted in some missed opportunities to collect meaningful data.

The author also chose to conduct a survey using a questionnaire as a means of gathering more empirical data than could be obtained through personal interviews. Survey results were also sought to explore whether quantitative data might reinforce (or contradict) many of the perceptions the author had acquired in exploring this thesis. The author developed the survey. However, Dr. Victoria Scherberger, the approval authority for surveys within the Army's Command and General Staff College (CGSC), did edit it. The survey was of the forced choice variety with the majority of the questions using the

Lichert five-point scale. The survey also encouraged participants to write comments, if desired. Appendix A lists the survey questions in their entirety and details the results.

The researcher gave the survey to airmen at two different locations. The first population group was comprised of Air Force faculty and students assigned to CGSC who had previous experience piloting or being a crewmember of aircraft with air-to-ground attack missions. Twenty-two officers (not including the author) met the criteria listed above, and all received a survey. The author distributed surveys either by hand or by putting them in people's personal message folders. Participants were not given any time constraints in taking the survey. All twenty-two people responded to the survey.

The author also mailed a batch of fifteen surveys to a colleague serving in an operational F-16 unit with approximately twenty-six pilots assigned to it. The author's colleague distributed the questionnaires to pilots in the squadron, collected them, and mailed them back to the author. As with the CGSC group, respondents were under no time constraints in filling out the surveys. Thirteen of the fifteen surveys were returned.

The biggest benefit of using a survey to help support the thesis was a means to gather empirical data pertinent to the subordinate and primary research questions. In this case there is some truth to the adage, "There is strength in numbers." As mentioned above, the survey was a vehicle that reinforced the accuracy of the author's perceptions. Writing that 90 percent of a certain population group agrees with something is more credible than the author offering his opinion about it.

While useful to this project, employing a survey as a research technique did have some weaknesses The population groups do not represent a large enough sample to make any inferences that one can extrapolate to the rest of the Air Force. Additionally, the vast

majority of the aviators who participated in the study come from the group of people that the author referred to earlier as those who execute policy. It was impractical for the author to survey senior officers who bear, or have born, the responsibility of making policy in this area. The survey method, like the personal interview, also suffered from the author's inexperience with developing questionnaires. The author discusses specific lessons learned in chapter 5, but certainly, in hindsight, the questionnaire could have been significantly better.

Individually, none of the research methods would have contributed adequate information to answer the primary and subordinate questions. However, when used in a mutually supporting role, they provided enough data to complete the project. Some methods applied more appropriately to certain questions than others. The following paragraphs review the three subordinate questions that the next chapter addresses and explains which particular research methods the author applied in answering each one.

What common attributes should effective air-to-ground target correlation criteria share? This is the first subordinate question. To collect data on this question the researcher used personal interviews and a search of available literature. The author chose the personal interview methodology for this question because he wanted the interactive discussion the interview format afforded him. A good answer to this question requires some cognitive analysis. The author chose not to address this question in the survey instrument because he was concerned that responses that were not thought through might taint the data. The interview allowed the author to pose the question and let people think about it for a while, before they offered and answer.

The author's analysis of the subordinate question, Is the current paradigm for articulating air-to-ground target correlation (or identification) criteria effective? is based on research compiled using all three methods. The survey instrument was particularly applicable in helping gather data that served to define the current paradigm as well as capture airmen's opinions about it.

The third subordinate question is, Should the commander tailor air-to-ground target correlation criteria to individual missions and targets, and if so, what framework might allow the commander to do this effectively? Information used to address this question came primarily from the questionnaire and from personal interviews. The reason that literary sources did not support analysis of this question is that the author found nothing in his research that addressed this question.

CHAPTER 4

RESULTS AND ANALYSIS

This chapter addresses the results and analysis of the author's research at it pertains to answering the subordinate research questions. The goal of this chapter is to develop answers to the subordinate questions as a foundation to answering the primary research question in the following chapter. Each of the sections of this chapter examines one of the three subordinate questions laid out in the introductory chapter. For the reader's ease, the primary and subordinate questions are listed below.

Primary research question: How should a joint force air component commander effectively integrate air-to-ground target correlation criteria into air combat operations?

Subordinate questions:

1. What common attributes should effective air-to-ground target correlation criteria share?

2. Is the current paradigm for articulating air-to-ground target correlation (or identification) criteria effective?

3. Should the commander tailor criteria to individual missions and targets, and if so, what framework might allow the commander to do this effectively?

Subordinate Question 1

An answer to the first subordinate question is important to the development of the thesis because it helps to set the conditions for measuring success. To answer the question of how a JFACC *effectively* integrates criteria into an air operation, it is useful to grasp two central ideas. First, one should understand the function or purpose of air-to-ground correlation (or identification) criteria. Comprehending the function of the criteria

is fundamental to evaluating how effective it is. Second, with a given function in mind, it is also helpful to perceive common attributes that effective criteria share. These common attributes, or measures of merit, then become a tool that can help someone evaluate a given set of criteria. Additionally, they are useful in shaping development of future criteria. This section aims to answer the first subordinate question by first discussing the function of air-to-ground target identification criteria then establishing measures of merit for effective criteria.

Function of Air-to-Ground Target Correlation Criteria

In order to understand what common attributes effective air-to-ground target correlation criteria should share, it is instructive to first examine the function or purpose of the criteria. Why does a commander have this sort of guidance? What is he trying to achieve by having it? Analysis in this section is based on the data gathered through the search of available literature and through personal interviews.

As the author already noted in chapter 2, joint doctrine and Air Force doctrine barely address air-to-ground ID criteria. There is certainly no doctrinal definition of the term, nor is there any direct reference that a commander should prescribe this type of guidance. Yet, this type of guidance certainly exists, so one must look to other means to discern its function. One method is to examine what doctrine says about the function of the broader category of ROE and then apply that to the subject of air-to-ground target correlation criteria.

The Department of Defense dictionary defines ROE as, "Directives issued by competent military authority which delineate the circumstances and limitations under which United States forces will initiate and/or continue engagement with other forces

encountered" (Department of Defense 1989, 377). Steven Randolph's article, "Rules of Engagement Policy and Military Effectiveness: The Ties that Bind," addresses the purpose of ROE. He writes that, "ROE exist for one purpose: to translate policy objectives into military activity. They seek to harness the deadly force of military action toward achieving rational policy ends" (Randolph 1993, 4).

Since air-to-ground correlation criteria are essentially a subset of ROE, one can draw some logical conclusions as to their function from the preceding paragraph. First, criteria is directive in nature. In other words it articulates rules that should be followed, not just information or advice. Second, correlation criteria should establish circumstances and limitations, or boundaries, on when an airman should use force. In this context, that use of force equates to dropping his bombs based on his confidence that he is engaging the correct target. Third, air-to-ground correlation criteria exist to help achieve particular policy objectives. Therefore, one can postulate that the purpose of air-to-ground target correlation (or ID) criteria is to implement national policy by establishing expected standards of confidence that an airman is engaging the correct surface target prior to weapons release.

Common Attributes of Effective Correlation Criteria

The segment above concluded that the function of a set of air-to-ground target correlation criteria is to implement national policy by establishing standards of confidence that an airman is engaging the correct surface target prior to weapons release. If that is the purpose of the criteria, how does one differentiate between a system that does this well and one that does not? Based primarily on his examination of available literature and personal interviews, the author has derived five primary measures of merit

for effective air-to-ground target correlation criteria. Effective air-to-ground target correlation criteria should:

1. Establish clear standards

2. Support the commander's intent for the amount of correlation risk he is willing to assume

3. Not be overly restrictive

4. Be executable at the tactical level

5. Apply across the spectrum of delivery platforms, missions, and targets expected to be involved in an operation.

The qualities listed above are not the product of a single reference, but the synthesis of a number of different sources. Some of the qualities the author took from literature addressing ROE in general, while others come from information gathered during personal interviews. The list evolved throughout the project as the author spoke or corresponded with various subject matter experts including military lawyers, aviators, and staff members of air combat commanders. Their inputs either reinforced the applicability of the qualities on the list, or sent the author back to the drawing board. Through this interactive research process, the author has arrived at what he believes are the primary attributes that effective air-to-ground target correlation criteria should share. The next part of this section addresses each of the measures of merit listed above. The section concludes with a short discussion on some of the research results that the author decided to not include as attributes for effective criteria.

Effective criteria should establish clear standards. This attribute of effective criteria essentially implies two related imperatives. One is to establish a standard. The

other is for that standard to be clear. As one aviator put it, "We have to know what is expected of us" (Mattison 1999). Lieutenant Colonel Mike Schmitt of the United States Air Force Academy Law Department, and a specialist in operational law, agrees. One of his first tests for effective ROE is that they must be clear (Schmitt 1999). Webster's *Third New International Dictionary* defines clear as: having no doubt, confusion, or uncertainty of mind. Furthermore one article on ROE notes that ROE must be understood through all levels--from the person releasing the weapon to the highest echelons of command (Thompson 1995).

When applied to military operations, clear standards should mean that different people in identical circumstances would likely apply the criteria the same way. For instance, suppose the aerial rules of engagement for a peace enforcement operation state that pilots may engage another aircraft if that aircraft displays "hostile intent." Without some explanation of what the policy maker means by hostile intent, there is a reasonable chance that pilots will have different ideas as to what situations might meet that standard of hostile intent. One pilot's standard of hostile intent might be an aircraft flying toward him at high altitude and high speed, because this profile optimizes the launch envelope of many air-to-air missiles. Another airman may conclude that the standard of hostile intent is not met until the opposing pilot locks-on to a friendly aircraft with his fire control radar. Thus, because there is a likelihood of confusion, using the term hostile intent, without elaborating on its meaning, would not represent clear guidance. Similarly, air-to-ground correlation criteria should leave as little room for confusion as possible. Since many different aviators will execute air-to-ground correlation criteria, it must articulate clear standards so airmen will apply the criteria relatively uniformly.

Effective criteria should support the commander's intent for the amount of correlation risk that he is willing to assume. The author decided to include this attribute based on a discussion with a former instructor at the Air Force Weapons School, Major Chris Weggeman. He rightly pointed out that this measure of merit goes to the very purposes that air-to-ground correlation criteria are trying to achieve. The commander disseminates this guidance to support policy objectives in this area. Effective criteria cannot have disconnects between the commander's policy objectives and the standards he establishes. In other words, the criteria should not result in aviators taking more correlation risk than the commander thinks prudent. Operation DELIBERATE FORCE provides an excellent historical example. In this operation one of the commander's objectives was for zero collateral damage. Accordingly, the air-to-ground target ID criteria were very strict. The commander wanted to minimize his correlation risk (Walker 1999). What factors a commander should look at when determining how much correlation risk he wants his subordinates to accept is a separate question that the author already touched on in chapter 1.

While air-to-ground target correlation criteria need to support the amount of correlation risk a commander is willing to accept, they should also not be overly restrictive. Overly restrictive, for the purposes of this discussion, refers to the gap between the correlation risk a commander is willing to accept, and the standard of correlation required by his criteria. For example, having a very stringent correlation criterion in a situation where the commander would be willing to accept a fair amount of correlation risk would not contribute to having effective ROE. The most important reason for this is that it unnecessarily ties the hands of airmen who must execute the

mission. The greater the difference in the amount of correlation risk with which the commander is comfortable, and the de facto correlation risk imposed by a set of criteria, the greater probability an aviator will not drop a bomb in a situation where the commander would have wanted him to drop.

There is another way in which overly restrictive criteria can develop, but which the author is excluding from the analysis. This occurs when policy makers give too much consideration to the political influence of the ROE, at the expense of the military operational requirements. The air operations during the Vietnam War provide an excellent example. Many people have derided the extremely restrictive ROE in place prior to the LINEBACKER campaign during the month of December 1972. One author noted that the ROE placed too much of a burden on U.S. forces and unnecessarily tied the hands of the military in executing effective bombing campaigns. He does observe, however, that the ROE were in full compliance with national policy (Thompson 1995). The point here is that this thesis refers to overly restrictive in the sense that policy and intent do not get translated effectively into comparable ROE, not when the premise of the ROE is in dispute.

One set of criteria for an Air Force exercise several years ago stated that, in order to release their bombs, pilots must positively identify either the target or an offset aim point within fifteen miles of the target (USAF 35th Fighter Wing 1994). One particular target set did not show up on radar very well, nor were there any good radar-significant offset aim points within fifteen miles. Weather in the target area during mission execution precluded visual identification, therefore twelve F-16s brought their bombs back to the base. They did this because they could not comply with the ID criteria. The

next day, when the mission was re-tasked, aircraft simulating enemy interceptors jumped the twelve-ship. The result was that four friendly F-16s were judged to be shot down and five others had to simulate jettisoning their bombs to repel the air threat. Had the criteria allowed the pilots to drop the bombs through the weather using their GPS-aided bombing computer, the mission could have been successfully accomplished the first day. The simulated political and operational environment of the exercise was such that the commander would have been willing to accept the increased correlation risk of the GPS-aided delivery. While this was only an exercise, it serves as a good historical example of where overly restrictive criteria adversely impacted mission accomplishment and had lethally negative consequences.

Effective criteria should be executable at the tactical level. All the operators and military lawyers who were asked about this measure of merit agreed that it should be included. Thompson (1995) notes that the entire chain of command needs to make sure that the ROE has relevance to the mission. He goes on to point out that commanders must be aware of the impact of the ROE on the man in the field. Criteria must be written from the perspective of the airman so that he can accomplish the goals of the commander. Being executable at the tactical level does not mean that aviators have to like the ROE, only that it is consistent with the operational environment and other guidance, and that it cohesively fits within the framework of aviators' real-time decision making processes. It must not be too complicated, nor rely on information to which airmen do not actually have access.

Consider a scenario where the U.S. is using airpower to help an ally quell an insurgency in its country. The air commander has tasked attack aircraft to strike rebel

camps located in the jungle. The commander's guidance to the A-10 pilots involved in the operation is to bomb the camps so long as there are not refugees there at the time. This guidance is likely not executable at the tactical level, because it would be virtually impossible for the pilots to determine whether there were refugees in the camp or not. If there was an observer on the ground that could somehow radio or otherwise signal the pilots of the camp status, this might be more effective ROE. But without something along those lines, the ROE, despite its good intent, is not effectively executable by the A-10 pilots.

Effective criteria should apply across the spectrum of delivery platforms, missions, and targets expected to be involved in an operation. Major Jeffrey Walker, of the Air Force Office of Operational Law, offered this concept as a common attribute of effective criteria. He used the word seamless to encapsulate this thought. To be effective, criteria cannot address one aspect of the air-to-ground operation but not another. This is not to say that the same standard must be used in every situation, but that the criteria has accounted for the range of situations that airmen in which airmen are likely to find themselves. Criteria may not be able to address every imaginable scenario, but the more gaps it has in it, the less effective it is (Walker 1999).

A set of criteria that established standards for correlating stationary targets, but did not address mobile targets would have a certain weakness, if there was a potential that aviators would have to engage mobile targets. Similarly, criteria that articulated correlation requirements for some of the specific delivery platforms in an operation, but not others, would be less effective than they might. The more seamless a set of criteria is, the more often an airman will be able to implement the commander's policy objectives.

The author did not include all of the information or opinions he came across. There were a number of suggested attributes of effective air-to-ground correlation (or ID) criteria that the author decided either were better thought of as a subset of a particular measure of merit, or not appropriate. For example, one of the tests of effective ROE that Major Walker offered is that they are simple. One of the fighter pilots the author interviewed also suggested that simple would be a good measure of merit (Rice 1999). While the author agrees that simple ROE are easier to execute, he felt that the quality of being executable at the tactical level was a more descriptive requirement. Being simple is only one of the ways of helping to make this happen. ROE should be simple so that they are executable at the tactical level. Being simple in and of itself serves little purpose. A possible danger with this approach is that the supporting quality of being simple may be lost as one of the desired attributes of being executable at the tactical level.

One quality that the author decided to not include as a sixth attribute of effective criteria was that they are specific to different targets and missions. There was much agreement among the airmen surveyed that correlation or ID requirements ought to be specific to different targets and missions. However, feedback from personal interviews convinced the author that this quality is not a necessary prerequisite to an effective set of criteria. Operation DELIBERATE FORCE is a good example of where the ID criterion was the same across the board, yet critical analysis judged the ROE to be very effective (Owen 1998). The segment addressing the third subordinate question discusses this concept in more detail.

Using the five measures of merit discussed in the this section as a basis of analysis, the next sections of this chapter address the second and third subordinate questions by examining two different frameworks for integrating air-to-ground target correlation criteria into combat air operations. First, the author evaluates what he perceives to be the current paradigm used in air operations. The final section of the Chapter 4 looks at the strengths and weaknesses of a different approach to the problem.

Subordinate Question 2

The second subordinate question asks, Is the current paradigm for articulating air-to-ground target identification criteria effective? This question necessarily implies that one must first define what the current paradigm is, then evaluate whether or not it is effective. This section begins with a discussion of how the author arrived at his perception of the current paradigm. The remainder evaluates the current paradigm, concluding that, while the "positive ID" paradigm has certain strengths, its drawbacks make it a less than optimum approach for articulating command guidance across a spectrum of scenarios.

The author began this project with a preconceived notion about what the current paradigm is. That hypothesis was that the usual method of articulating air-to-ground ID criteria was to use a criterion that stated something along the lines of, "Pilots and aircrew will positively ID the target prior to weapons release." In order to test the veracity of the hypothesis, he first examined joint and Air Force doctrine to see if either source established authoritative direction on how to integrate criteria into combat air operations.

As chapter 2 explained, neither joint nor Air Force doctrines address the topic of air-to-ground target ID criteria in suitable detail. Thus, one cannot infer from doctrine

that the positive ID paradigm is the one that pervades operations. The author's own experience, as well as the personal interviews he conducted, supported his hypothesis. A pilot who participated in Operation DELIBERATE FORCE, the air strikes in Bosnia during the fall of 1995, confirmed that the positive ID criteria was essentially what they used in that operation (Godier 1995). This information was further confirmed in the ROE chapter of the DELIBERATE FORCE case study (Owen 1998). Aviators who flew during the Persian Gulf War also operated under the positive ID paradigm (Schmitt 1999).

To further test the author's hypothesis he used a survey to gather quantitative data. Eighty-three percent of the aviators surveyed agreed that the phrase, "Pilots/aircrew will positively identify the target prior to weapons release," was representative of air-to-ground ID criteria they had experienced in exercises and real world operations (appendix). Based on the results from the survey question, and knowledge gained from the literature search and personal interviews the author is confident that he has correctly identified the current paradigm. As such, the next part of this section evaluates the strengths and weaknesses of an air-to-ground target identification criterion that directs airmen to positively identify the target prior to weapons release.

Two of the measures of merit that the author derived in the previous section were that effective criteria should establish clear standards and that they should be executable at the tactical level. Of the thirty-five airmen surveyed, only 32 percent agreed that the positive ID criterion was clear and executable (appendix). One of the survey comments was, "Subjective!" Another asked, "How do we define positive ID?" Herein lies one of the drawbacks of the positive ID paradigm. Operators do not always understand what the

commander means by positive ID. The term is not defined or explained anywhere in doctrine or policy. Thus, aviators must often rely on their own perception of what the term means, and subsequently, how they intend to apply it in combat. When the author asked one senior leader, a year ago, what he meant by positive ID, he responded, "It's simple, make sure that you know you're bombing the right target." While that phrase and the term positive ID may sound similar, there is an important difference. The former does not imply that the airman must identify the target.

The results of another of the survey questions effectively illustrate the differences of opinion as to what positive ID means. When asked whether positively identifying the target imposed severe restraints on the aviator, the survey indicated a wide range of responses. Forty-two percent of the airmen surveyed agreed, or strongly agreed that it did, while 38 percent expressed the exact opposite opinion. Meanwhile, 20 percent of the respondents were neutral on the question (appendix). The even, to slightly polar, distribution of responses given to this question indicate the lack of common understanding as to what the term means and how it should be applied.

Interviews with airmen who are expected to execute the policy also show a wide range of opinions as to what constitutes positive ID. In one F-16 pilot's opinion dropping a bomb after identifying an offset aimpoint met the requirements of the positive ID criteria. His logic was that this was a common technique used in the planning process of strategic bombing missions planned and approved at the highest levels, so therefore, that approach must, by default, meet the intent of positive ID (Norman 1999). However, another F-16 pilot disagrees. His perception is that since he is not identifying the target, but rather the offset point, he has not satisfied the criterion (Weggeman 1999). A

telephone interview with a former B-52 weapons system operator brought out another viewpoint as to what positive ID meant to him. In his experience, positive ID meant that if he had done everything within his ability and the capability of the aircraft systems to make sure he was bombing the right target, he had satisfied the criterion. Interestingly, he also admitted after a moment's reflection, that his interpretation would likely make great evidence at his court-martial (Walker 1999).

Lieutenant Colonel Schmitt, a faculty member at the United States Air Force Academy's Law Department, offered insight that brings the lack of clarity of the positive ID paradigm into perspective. He noted that the underlying purpose of air-to-ground ID criteria is to help the military commander implement national policy. If airmen are having to guess as to what the commander really means by positive ID, then how are they supposed to effectively implement policy? In his experience, positive ID during DESERT STORM had a much more liberal interpretation than positive ID during more recent, limited air operations (Schmitt 1999).

Another reason that only 32 percent of the airmen surveyed may feel that that the positive ID paradigm represents clear and executable guidance is that the literal interpretation of the guidance is not in accord with airpower employment on the battlefield. Only three of the thirty-five, or 9 percent, of the aviators who participated in the survey agreed that the phrase, "Pilots/aircrew will positively identify the target prior to weapons release," was consistent with current and pending munitions and tactics (appendix). Stefanek's thesis, "Close Air Support Using Inertially Guided Weapons," also pointed out that the positive ID paradigm was not appropriate for using GPS-guided munitions such as the Joint Defense Attack Munition and the Joint Standoff Weapon

(Stefanek 1998). Similarly, Major Walker noted that standoff ranges make it physically impossible for a B-52 crew to identify the target prior to releasing a cruise missile (Walker 1999).

In regards to establishing clear standards and being executable at the tactical level, the positive ID paradigm does have certain strengths. First, if the commander clarifies that what he really expects from his airmen is indeed *positive identification of the target*, one can argue that it could be considered a clear standard. While perhaps not perfect, because it does not define what positive ID means, it does communicate the commander's intent. He expects airmen to: (1) identify the target and (2) be absolutely sure, or positive, that they have the right target. As long as this is what the commander really wants, and understands the constraints this places on his aviators, it could probably be considered a clear standard. The reason it becomes ambiguous is because meaning the phrase has never been codified by doctrine, and its practical application has varied.

Another merit of the positive ID paradigm is that it is simple. Assuming one can capture a definition of positive ID, the standard is the same across all missions and targets. It does not change with shifts in policy nor the operational environment. This helps make the criteria easy to integrate into combat air operations. It also makes it easy for aircrew to train with it. Ironically though, its simplicity can also be a weakness.

One of the measures of merit for effective air-to-ground target correlation criteria is that they should support the commander's intent for the amount of correlation risk that he is willing to assume. Does the positive ID paradigm do this? Positive ID, when practiced in its literal interpretation seems to be about as stringent of an ID requirement as possible. One former legal advisor to the Combined Force Air Component

Commander for operations on southern Europe offered the term "positive visual identification" as the only thing he could think of that might be more restrictive (Walker 1999). Adding the term visual would ostensibly preclude the use of sensors, such as radar or IR, thus requiring aviators to actually see the target. Because the positive ID requirement communicates that aviators should accept essentially zero correlation risk, it should effectively support the commander's intent. The drawback is when it does this too well and becomes overly restrictive.

Is having to positively ID the target prior to weapons release an overly restrictive criterion? The answer to this question is likely a function of the particular situation. Lieutenant Colonel Schmitt observed that in air operations in which the United States was involved during the past few years, the positive ID criterion was not overly restrictive. This was because of the limited scale of the operations, and the policy objectives that the military action was trying to achieve. In air operations such as Desert Strike, DESERT FOX and DELIBERATE FORCE accidentally bombing the wrong target would have been tremendously counter-productive to achieving policy goals. Therefore, air-to-ground ID criteria, and other related ROE, were correct in being very restrictive (Schmitt 1999).

At the same time, Schmitt, as well as others, can easily conceive of future combat air operations where a positive ID criterion would be overly restrictive. They agree that, in situations where the commander would be willing to accept some degree of correlation risk, the positive ID criterion becomes overly restrictive. Figures 3 and 4 on the next page illustrate the point. The values in these and subsequent charts are notional. For each target, the bar on the right represents the nominal confidence required by the ID

criteria. The bar on the left depicts an example of how much confidence the commander requires based on his analysis of a particular mission and target. The difference in height between the two bars represents a disconnect between an acceptable standard and the required standard.

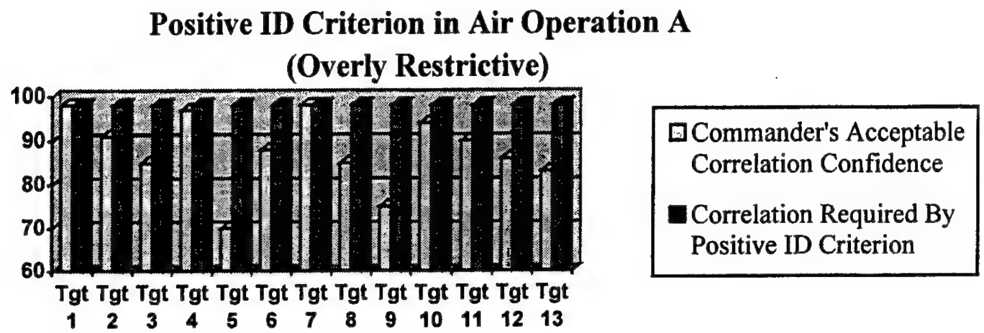

Figure 3. Acceptable Confidence Versus Required, Positive ID, Air Operation A

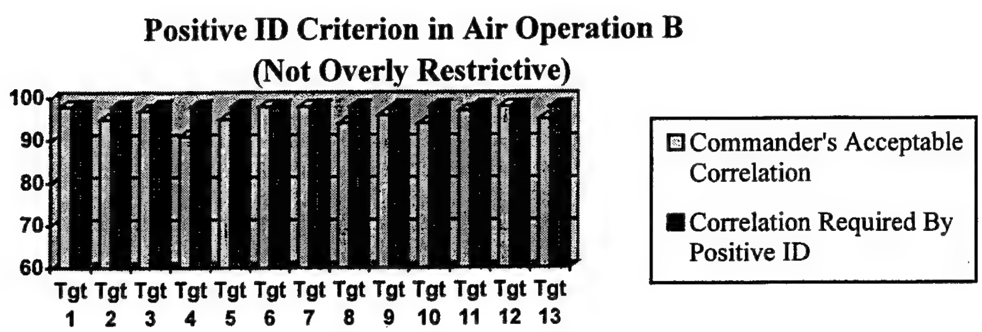

Figure 4. Acceptable Confidence Versus Required, Positive ID, Air Operation B

The difference between Air Operations A and B is the amount of correlation risk the commander is willing to assume. Perhaps air operation A represents a major regional conflict such as DESERT STORM or a war on the Korean peninsula. Air operation B, on

the other hand, might represent a military operation other than war similar to Operation DESERT FOX. Regardless of the type of operation, air operation A depicts a situation where broad based positive ID paradigm results in significant unnecessary restrictions on U.S. airmen.

A pilot with recent experience in Korea explained his need for less restrictive criteria in certain circumstances if aerial bombing operations are to be effective against a North Korean attack. If he is attacking enemy troops that are nowhere near known friendlies, he should be given the flexibility to not be required to positively ID them. Doing so would expose him to too much enemy fire. He would prefer to use his situational awareness to confirm that he is engaging the bad guys, then employ standoff tactics that improve his chances of survival while still dropping accurate bombs (Rice 1999).

One last evaluation of the positive ID paradigm to consider is how well it applies the spectrum of delivery platforms, missions, and targets expected to be involved in an operation. Its effectiveness in this category is mixed. At first glance, the criterion appears very seamless. It implies that positive ID is the standard required on all missions in which pilots and aircrew are releasing air-to-ground munitions. By not addressing specific missions, delivery platforms, or types of targets, it implies that it applies to all of them. However, in some situations, the applicability breaks down. Major Walker observes that the positive ID paradigm really does not apply to aircrew launching cruise missiles from B-52s. Since their launch conditions, hundreds of miles away from the target, do not permit them to even begin to identify the target, what criteria do they use? He goes on to point out that other assets sometimes fall under the JFACC's operational or

tactical control, but are not operated by pilots or aircrew. Examples of this include the Navy's Tomahawk Land Attack Missile and the Army Tactical Missile System. While technically surface-to-surface munitions instead of air-to-ground munitions, they are essentially the same class of weapon as a cruise missile (Walker 1999). The challenge will only get more formidable as the trend toward standoff, long-range weapons, and unmanned delivery methods continue.

On the whole, the positive ID paradigm, as it appears to stand right now, has limited effectiveness as the only framework for air-to-ground criteria for future combat air operations. Its major drawbacks include; its lack of clarity, its inconsistency with systems, munitions and tactics with which Air Forces will likely fight the next conflict; and its inability to account for varying degrees of correlation risk that a commander might want to accept. The positive ID paradigm can be effective, however, in air operations where the commander wants to accept minimal correlation risk across the board. As employers of airpower posture themselves for the next conflict, one must wonder if there might be a different way to approach the problem. The third subordinate question addresses that topic.

Subordinate Question 3

Should the commander tailor criteria to individual missions and targets, and if so, what framework might allow the commander to do this effectively? This is the third subordinate question and the focus of this segment of the chapter. This section opens by assessing the advantages and disadvantages of a framework where the correlation criteria are tied to specific targets and missions on the ATO. It does not analyze a particular method to accomplish this, but only the generic approach to the problem. The second

segment builds on the conclusions to the first part of the question by hypothesizing a process, which the author will refer to as the correlation matrix paradigm, for integrating situational air-to-ground target correlation criteria into combat air operations. The final part of this section evaluates the author's hypothesis against the measures of merit for effective criteria.

Before getting into the merits and drawbacks of articulating requirements to specific missions, it is worthwhile to briefly review the target tasking process this thesis assumes is in effect. The thesis will go into more detail later, but the goal of the next two paragraphs is to give the reader a basic understanding of how individual aircrew members and pilots get their tasking from the JFACC.

This paper assumes that the JFACC is responsible for tasking missions to subordinate units through an ATO. The ATO assigns a specific number of aircraft, from a particular unit, to support a given mission. Unit commanders then determine which airmen will support which missions the JFACC has assigned to their unit. Mission types vary with unit specialties and airframe types. They include such missions as defensive counterair, reconnaissance, and airlift, but this discussion focuses on those missions involving air-to-ground bombing.

For each air-to-ground mission with a preplanned target, the ATO lists the coordinates for the target, or targets. It is possible to have more than one target within a mission. This could happen because each of the four aircraft on a particular mission is assigned a different target. Sometimes too, a single aircraft may be given more than one target for a sortie. For instance, an F-117 might be tasked to drop one laser-guided bomb on one target and another on a different one. Additionally, within a target there may be

more than one specific aimpoint that could be hit. Examples of this might be two opposite ends of a bridge or various buildings within a communication facility. These are referred to as desired mean points of impact, or DMPIs. The ATO lists the coordinates of the specific DMPIs that planners want the aircraft to attack. However, information on the ATO is grouped and organized by mission, not by individual aircraft, targets, or DMPIs. Each mission is assigned a unique number for administrative purposes. Thus, on an interdiction mission number "xxxx", the JFACC might task the mythical 88th Fighter Squadron to provide four F-15Es to attack two different bridges, hitting four different DMPIs. The crews of the F-15Es would find four different sets of coordinates, along with other pertinent information, grouped under one mission number.

Evaluating Generic Situational Correlation Criteria

Just as the JFACC communicates specific coordinates for each DMPI he tasks, he could conceivably also communicate specific target correlation criteria. Exactly how he could do this will be addressed later. This part of the chapter focuses on whether he should. In other words, what are the advantages and disadvantages of this general approach to specifying air-to-ground target correlation criteria?

When asked whether target ID requirements should be specific to individual targets and missions, 88 percent of the airmen surveyed agreed that they should (appendix). Clearly, the survey population recognizes that all targets were not created equal and that they would prefer to mate criteria to specific targets, rather than execute the same standard across the board. Major General Kinaan, commander of the Air Force Doctrine Center, agrees that different targets might demand different correlation considerations. He related that, while they did use positive target ID as the identification

criteria for Operation DELIBERATE FORCE, he and other senior leaders used other control measures to accomplish a similar objective. Remember, in DELIBERATE FORCE military and political leaders perceived even minor collateral damage to be extremely counterproductive to policy goals. Therefore, they sought to minimize the potential for collateral damage by managing what airframe types and which members of the multinational coalition were tasked against which targets. Coalition member Air Forces with less accuracy and precision only allowed to attack certain targets. In essence, the policy makers in DELIBERATE FORCE conducted risk analysis for where they could afford to engage targets with less accurate means, then used their available airpower to mitigate that risk while still achieving operational effectiveness (Kinaan 1998).

The preceding paragraph offers perspectives about the efficacy of situational criteria from both the bottom, those who execute policy, and the top, a senior leader who helped develop it. But, how does a situational set of criteria stack up against the measures of merit the author derived from the first subordinate question? In this discussion, the author will touch on three of the five measures of merit. These three will be that; effective criteria should support the commander's intent for the amount of correlation risk that he is willing to accept, effective criteria should not be overly restrictive, and they should apply across the spectrum of delivery platforms, missions, and targets for a given operation. The other two attributes are not very applicable when evaluating this generic method for articulating air-to-ground target correlation requirements. Just because criteria are tailored to individual targets and missions, that does not inherently do anything to ensure, or preclude, that the criteria establish clear

standards. Likewise, this particular discussion is too general to determine whether this type of criteria would be more or less executable at the tactical level than another.

A set of correlation criteria that is specific to individual targets and mission is more likely to support the commander's intent for the amount of correlation risk that he is willing to assume. The reason for this is that it provides a vehicle for the commander to express varying degrees of correlation risk for his airmen to take. With situational criteria, he can better express his intent. Lieutenant Colonel Schmitt agrees with this approach in concept because it forces a commander to conduct some sort of correlation risk analysis (Schmitt 1999). In situations where the commander wants to assume very little correlation risk, he can articulate very restrictive correlation criteria. On the other hand, in instances where his analysis concludes that accepting some correlation risk is worthwhile to the overall objectives of the operation, he can articulate less restrictive criteria.

When the commander conducts correlation risk analysis and also has in place a process that allows him to integrate situational criteria, the resultant criteria are much less likely to be overly restrictive. The benefit to be gained is that the criteria will be less likely to detract unnecessarily from military operational effectiveness. Ideally, the commander could translate the qualitative evaluation for the amount of correlation risk that he is willing to accept on a given target into a clear standard for an aviator to execute on the mission. Also, in the ideal, he could do this for every target he tasks to his subordinates. Granted, the ideal is likely impossible to achieve in actual application, but that will be addressed later in this section. Figure 5 illustrates the point. The greater the differences in the amount of correlation risk the commander is willing to accept among

various targets, the more attractive is a situational air-to-ground correlation criteria. If there is little to no difference among targets, then situational criteria may not be needed.

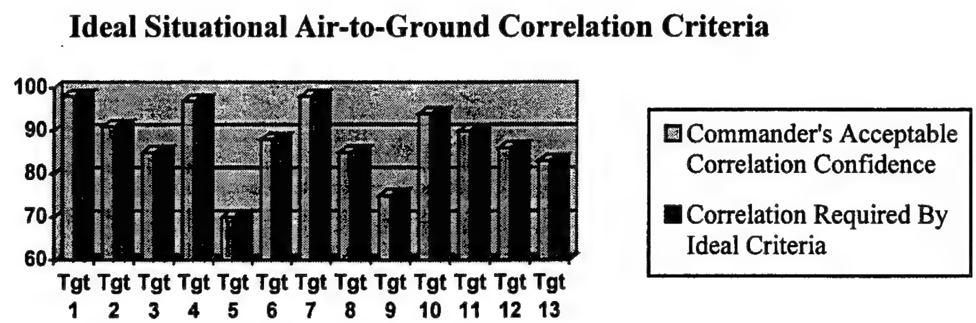

Figure 5. Acceptable Correlation Confidence Versus Required, Ideal

Situational criteria are more likely to apply across the spectrum of delivery platforms, missions, and targets expected to be involved in an operation. The reason for this is that the paradigm forces the policy maker to consider each part of the equation. Since each mission in an ATO is tied to a particular delivery platform and one or more specific targets, the JFACC and his staff must consider these factors as they develop a particular set of correlation criteria for each mission. This certainly does not preclude errors from being made, but the framework, by it's fundamental structure, is more likely to be seamless.

So far in this section, the author has been addressing a generic, situational approach to articulating air-to-ground target correlation requirements. While the situational method has notable advantages in the ideal, the pertinent question is whether that ideal can be transformed into an effective working system? That is the focus of the rest of this chapter. The next four pages explain a process that the author hypothesizes a

JFACC could potentially use to integrate target specific correlation criteria into combat air operations. Following that, the author will evaluate his hypothesis, as he did for the positive ID paradigm, against the common attributes of effective criteria.

Describing the Correlation Criteria Matrix Paradigm

As noted earlier, the ideal situational criteria is able to translate the JFACC's qualitative assessment for how much correlation risk he is willing to assume for each target into a corresponding clear standard that aviators can execute. Without a detailed, face-to-face discussion between the JFACC and every airman on every mission, the ideal is difficult to achieve. Since it is unrealistic to expect the JFACC to personally brief each aviator, one must look for a more pragmatic solution which, while perhaps less than ideal, is still effective.

One process to integrate situational criteria into operations begins with the JFACC (with the help of his staff) conducting correlation risk assessment for each of the targets on the ATO. In his analysis, he groups targets into one of three correlation categories. He designates targets in which he wants to accept the least amount of correlation risk as Category I targets. Targets for which he is willing to accept slightly more correlation risk he identifies as Category II targets, and Category III targets for an ATO would be those on which he is willing to accept the most risk.

Depending on the scale of the operation, the JFACC may or may not be able to look at every individual target. For smaller operations such as raids, he will likely be familiar enough with each DMPI to make the decision himself. For larger campaigns, with hundreds or thousands target to process each day, he will need to rely more on his

staff. It is important to note though, that as the tasking commander, it is the JFACC's responsibility to make the decision.

In parallel to conducting risk analysis, the JFACC also develops a system for translating what each of the three correlation categories should mean to the airmen who must deliver the weapons. Each delivery platform, or weapons system, in the operation has a matrix, published in the SPINS, that defines correlation standards for each category. These categories capture the commander's intent for how much correlation risk he is willing to accept, or conversely, how much correlation confidence he expects. For instance, there is one matrix for F-15E aircraft, another for B-1s, and another for A-10s, et cetera. Ostensibly, these matrices would not change during the course of an operation. Exceptions to this might be, if a particular delivery platform upgrades its systems such that it warrants redefining its matrix or if the JFACC is not satisfied with the specific criteria for each category. Along with the matrices for each delivery platform, the JFACC should publish additional guidance that applies to all air-to-ground weapons systems. The purpose of this guidance is to clarify the commander's intent and to make the process more seamless. To this effect, table 1 on the next page lists the general notes that should be in the SPINS as well as a sample correlation matrix for an F-16C (table 2).

Table 1. Example of General SPINS for Air-to-Ground Target Correlation Criteria

1. For targets without a pre-planned target correlation category use Category II procedures.
2. If performing close air support with friendly troops within three nautical miles of the target use Category I procedures.
3. In certain circumstances the mission remarks section of the ATO may include specific guidance for a particular mission or target. This may include measures such as more specific correlation requirements or limiting weapons selection.
4. Regardless of the assigned target correlation category, airmen should make every effort to identify the target commensurate with sound tactics and the threat. For example, do not accept a blind system bomb against a Category III target, when a smart, tactical decision would allow you to ID the target prior to release. At the same time, identifying the target or offset with a particular sensor does not imply that the pilot or aircrew member must aim with that same sensor, if there is a more accurate method of putting bombs on target.

Table 2. F-16CG Specific SPINS for Air-to-Ground Target Correlation Criteria (Sample)

Target Correlation Category	F-16CG Air-to-Ground Target Correlation Requirements
I	• Identify assigned DMPI with a visual or IR sensor prior to release. • Do not release laser-guided bombs unless guidance to desired impact point is assured. • Use weapons and tactics that minimize the risk of collateral damage/fratricide.
II	• Identify assigned target, or target offset with a visual, IR, or radar sensor prior to release. • GPS guided munitions may be employed in the blind when the pilot has accurate target coordinates.*
III	IAW Category II, plus: • Identify the target area with a visual, IR, or radar sensor prior to release. • With accurate target coordinates and an aircraft system and GPS accuracy of "High/High" release of unguided munitions is authorized in the blind.[1] • Without a "High/High", a Fire Control Computer position update using a visual, IR, or radar sensor within five minutes prior to release is required.

Note *: Consider target coordinates down to a magnitude of .01 degrees to be "accurate."

The F-16 correlation requirements for each of the categories in the matrix (Table 2) communicate decreasing levels of correlation confidence. However, even Category III

requirements, the most inclusive and easiest with which to comply, demand a high degree of confidence that the pilot will engage the correct target. It is impossible to assign accurate percentages as to what confidence level each category corresponds, but they are all relatively high. Perhaps Category I targets equate to the 98-99 percent confidence level, Category II to the 90 percent, and Category III to the 85 percent correlation confidence level. Major Walker observed that the exact percentages are not important, but the JFACC and his staff do need to grasp the general degrees of confidence with which they are dealing. This is important so that category requirements for different weapons system roughly equate to each other. A given target on a mission should not be a Category II target for one airframe and a Category III target for another (Walker 1999).

The JFACC completes the process for pre-planned targets by annotating each DMPI in the ATO to one of the three target correlation categories. When airmen read their mission tasking they reference the SPINS for their specific requirements for that target. They can then complete their mission planning with regard for the specific correlation criteria they must meet. Not all targets that aviators will strike are pre-planned and appear in the ATO. Missions, such as close air support, killer scout, and interdiction, may be against mobile targets or stationary targets that are not identified in the normal ATO planning cycle. In these situations the procedure would be to use Category II criteria, as the note in the SPINS directs.

Evaluating the Correlation Criteria Matrix Paradigm

The process that the author described in the preceding paragraphs is markedly different than the current paradigm commonly used in exercises and air operations today. Is it an effective method for integrating air-to-ground target correlation criteria into

combat air operations? To gather data that would help answer this question the author used the survey instrument to get general perceptions about this framework for articulating criteria. To address effectiveness based on the measures of merit for effective criteria, he relied heavily on personal interviews. It is important to point out that the author used interviews to not only evaluate the correlation criteria paradigm, but also to shape its formation. Some interview feedback was actually incorporated into the design of the model described above. For instance, Major Creig Rice convinced the author to use three discrete categories instead of four. He also provided valuable input that resulted in the author removing the radar as a potential sensor with which F-16s can identify Category I targets (Rice 1999).

The survey population overwhelmingly agreed that the correlation matrix paradigm would be an effective approach to integrating correlation criteria into combat air operations. In fact, only 6 percent of the respondents answered that they did not think this would be an effective concept (appendix). Even one of the two respondents who answered that it would not be effective seemed to agree with the general principal, if not the details. He commented, "I think this type of guidance is too general still. Mission commander or flight commander should use this general basis for formulating specific criteria for crews/pilots. It is a good concept, but needs a middle man to make it effective" (appendix). Since the survey confirms that the general concept seems well founded, the next step is to look at the details of the correlation matrix paradigm by analyzing how well it stacks up against the measure of merit. The analysis is based on using the model described in the previous segment, including the example SPINS and the F-16 matrix.

Does the correlation matrix format establish clear standards? Feedback from personal interviews where the author either conveyed the concept of the paradigm, or actually let interviewees read draft versions of the paragraphs above, leads to the conclusion that it does. Clear standards are most important to the operators who must execute the commander's criteria. Therefore, the researcher interviewed fighter pilots assigned to Fort Leavenworth, Kansas, to determine if the sample criteria in the thesis for F-16s constituted, in their opinion, clear guidance. Each of the four pilots that the author interviewed considered the criteria to be clear. However, some potential ambiguities do exist (Mattison, Ravella, Rice, Speckhart 1999).

One interviewee noted that the primary thing that makes the criteria clear is that there is a discernibly different standard within each category. As a minimum standard pilots are supposed to identify the DMPI for Category I targets, the target or target offset for Category II, and the target area for Category III targets (Rice 1999). Another noted that one thing that helped to make it clear was that the language was written at a level which aviators could understand. In his words, it appeared to be, "Written by airmen, for airmen" (Speckhart 1999).

The criteria are not perfect though. One of the operational law experts that the author interviewed observed that the word "identify" still leaves much room for judgment, especially in the fast-paced environment of air combat (Walker 1999). Is there a difference between a procedure that directs airmen to identify a target rather than positively identify it? The latter, when used in relation to the former, seems to imply a stricter standard of confidence. Nevertheless, when either are used independently, they likely convey the same meaning. Furthermore, does a commander want to try to put his

arms around the concept and dictate to his airmen some sort of legalistic definition of the word? The general feeling from the operators that the author interviewed is that they would prefer to use their judgment, which also preserves flexibility.

One F-15E pilot also wondered how the correlation matrix paradigm deals with sensor limitations such as trying to distinguish between Scud launchers and civilian eighteen wheelers from medium altitude (Ravella 1999). This concern is also well founded. The bottom line is that aviators will still need to execute sound judgment to get the job done. Until sensor technology provides an effective means for airmen to distinguish between vehicle types from long range, there is a definite chance that someone will mistake one type for another.

One of the greatest strengths of the correlation matrix paradigm is that it can support the commander's intent for the amount of correlation risk he is willing to accept without being overly restrictive. The matrix approach allows the commander to communicate three different levels of correlation risk, rather than one. While not perfect, it is a significant improvement over a criterion that has only a single, overarching standard. Consider Air Operation A offered in the previous section and shown again on the next page.

Positive ID Criterion in Air Operation A

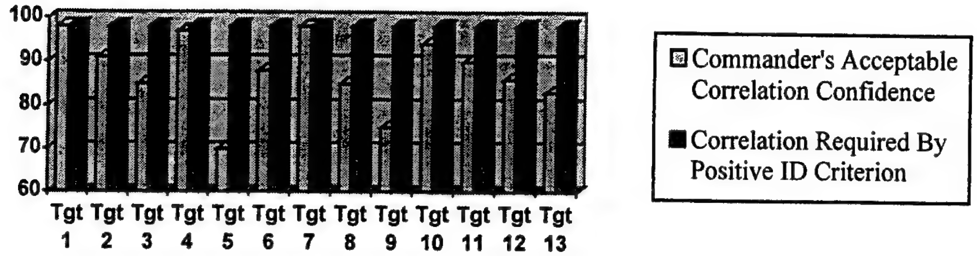

Figure 6. Acceptable Confidence Versus Required, Positive ID, Air Operation A

The positive ID paradigm directs airmen to take virtually zero correlation risk. The downside is that, against targets where the commander would have been willing to accept some risk, the aviators do not know this. Thus, they execute an overly restrictive criterion. With the correlation matrix concept, the commander now has a tool to communicate not only his intent, but also some of the procedures that he believes will support that intent during execution. Against the fictional target set of Air Operation A, the correlation matrix might be charted as in the example below. While not ideal, this framework much more closely matches the commander's intent and is consequently a more effective method for implementing policy (Schmitt 1999).

Correlation Matrix Paradigm in Air Operation A

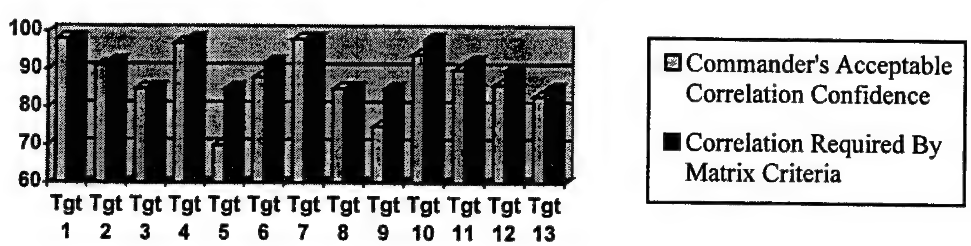

Figure 7. Acceptable Confidence Versus Required, Correlation Matrix, Air Operation A

To be effective, the correlation matrix process must be executable at the tactical level. In evaluating this measure of merit, there are two areas on which to focus. The first is whether airmen, tasked to a target and assigned a correlation category, can effectively execute the criteria. The second area to examine is whether the JFACC and his staff can effectively manage the process so that they can successfully mate correlation categories to all targets on the ATO.

Using this correlation matrix, or a similar process, would not be too different from what many airmen do already on their daily training sorties. Over half of the officers surveyed answered that, at their last operational unit, they briefed specific target ID criteria on at least 50 percent of their air-to-ground tactics missions (appendix). As long as the JFACC's criteria were written in a format that was clear and understandable, there would not be much difference between a flight lead deciding the criteria for a combat mission and the JFACC directing which criteria to use. Furthermore, the same four fighter pilots who believed that the criteria were clear also thought that they would have no problem executing it in the air. While not as simple as the positive ID paradigm, they did think it was neither too complicated nor too cumbersome to execute. One former supervisor of a fighter training unit stated that he thought the criteria were straightforward enough for pilots to be ready to execute them upon completion of their initial fighter training (Mattison 1999). Additionally, Major Rice's input to use three categories, instead of four, also helped to make the criteria simpler to execute. Another pilot observed that this set of criteria was much easier to execute than many air-to-air ID matrices he has used. This was because the decision process normally occurs on the ground and can be taken into account during the mission planning and briefing. Even if a

flight were to flex to a new target in the air, and theater procedures allowed for an updated target correlation category to be transmitted over the air, he still thought this matrix to be simpler (Weggeman 1999).

The aviators will not have criteria to execute if the JFACC and his staff do not make the prerequisite decisions and communicate them. Undoubtedly, it is this part of the process that departs substantially from previous ways of doing business. As the preceding paragraph points out, aviators often train to using specific ID or correlation criteria. However, the JFACC's staff at the joint air operations center is not trained to do this. Based on his experience in southern Europe, General Kinaan thought this process would be easily manageable for smaller scale air operations at least (Kinaan 1998). As the scope of an air operation expands, however, the task of deciding on the target correlation category for each target on the ATO grows more difficult. The potential strain this might put on the ATO process is certainly a drawback to the correlation matrix paradigm. The exact details of how a JFACC might manage this process within his staff, though, is beyond the scope of this thesis.

Along with having to make the decision, the JFACC also needs to communicate it through the ATO process. This presents some minor challenges, but none that cannot be overcome. Currently, the joint air operations center transmits the ATO through secure software architecture called the Contingency Theater Automated Planning System. The software does not support adding a notation for correlation category to each DMPI, but a work-around for this would be to annotate the information in the remarks section for each mission (Hunt 1999). By the year 2000, the military will be fielding new software architecture for formatting and transmitting the ATO. This program will be far more

flexible than the current system and should be able to incorporate this procedure into one of its mission data fields as long as the Air Force generates a requirement for it to do so (Parker 1999).

The final measure of merit to evaluate the correlation matrix paradigm against is whether it applies to all delivery platforms, missions, and targets expected for a given operation. The author's interviews asked pilots if they could, given the guidance above, imagine a situation as an F-16 pilot where they would not know what criteria they were supposed to use, or where the criteria would not apply. With one exception, the airmen responded that they thought the criteria and guidance covered all the bases. The exception, discussed earlier, was how the criteria apply to mobile targets that airmen cannot really be expected to identify (Ravella 1999).

Another limitation to this system is that someone must develop an effective matrix for each delivery platform involved in an operation. This involves having a good idea of which types of aircraft will be used for an operation as well as having an expert in the various delivery platforms who can transform the JFACC's confidence levels into clear correlation standards. A former member of a JFACC's staff observed that the JFACC's staff may not have weapons system expertise from each platform assigned to it. This would require that they coordinate outside of the staff to develop effective matrices (Norman 1999). Another former JFACC staff member suggested using the Air Force Weapons School as a central clearinghouse for helping to develop clear, concise matrices (Walker 1999). Of course, this would not address the integration of other service assets, but their respective advanced tactics schools could conceivably help provide a similar service.

When viewed in the aggregate, the correlation matrix paradigm can be an effective method for integrating air-to-ground target correlation criteria into combat air operations. Its primary strength is that it creates a vehicle for the JFACC to articulate the amount of correlation risk he is willing to accept when engaging a particular target. At the same time, it establishes clear standards commensurate with the commander's intent so airmen are not unnecessarily restricted in their employment. The principal drawback to this approach is that it requires effort on the part of the JFACC and his staff to make it work.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

When it comes to effectively integrating air-to-ground target ID criteria into both exercises and actual combat operations, there is significant room for improvement. Only 15 percent of the airmen surveyed thought that, within the last five years, the air-to-ground target ID criteria the tasking commander provided was effective at least three out of four times (appendix). That is not a particularly good batting average for something as critical as ROE. What can be done to improve performance in this area? Or, more specifically, How should a JFACC integrate air-to-ground target correlation criteria into combat air operations to make it effective?

Effectively integrating air-to-ground target correlation criteria into combat air operations begins with two fundamental premises that the JFACC must accept. The first is that, when it comes to correlation criteria, all targets were not created equal. In other words, different targets will often be deserving of varying levels of correlation risk. The amount of correlation risk acceptable to the commander will largely be a function of the physical potential for fratricide or collateral damage, the priority of the target, and the military and political landscape of the operation. The respective strengths of these factors will change when measured against specific targets, and may well change against the same targets over time. The second premise the JFACC must accept is that, allowing airmen to take prudent correlation risk will enhance the success of an operation. The reason to take risk is that the potential rewards are worth it. In air-to-ground operations, this translates to potentially more targets destroyed. Accepting these two premises leads

to the conclusion that the JFACC should conduct correlation risk analysis on the targets he tasks as well as develop a process to communicate the results of that analysis to the aviators executing the ATO. Therefore, to integrate air-to-ground target correlation criteria into combat air operations effectively, a JFACC should abandon the positive ID paradigm and adopt the correlation matrix paradigm. The remainder of this section highlights the reasons why he should do this.

The tool at the commander's disposal to communicate the results of his correlation risk analysis is his set of air-to-ground target correlation criteria. As directive guidance from the JFACC, they serve to both inform the aviator as to the commander's intent, while also providing procedures for the airman to follow. The JFACC can take many different approaches to developing criteria. However, to be effective, they should possess certain attributes. Effective criteria must establish clear standards and be executable at the tactical level. Furthermore, they should support the commander's intent for the amount of correlation risk that he is willing to assume while not being overly restrictive. Finally, the criteria must apply across the spectrum of delivery platforms, missions, and targets the JFACC expects to be involved in an operation.

The positive ID paradigm, which research suggests is currently the predominant approach to integrating criteria into air operations, has significant limitations. First, as a static criterion that cannot adapt to different levels of correlation risk, it works against the basic premise that different targets often deserve different amounts of correlation risk. Where the positive ID paradigm may have some validity is in those air operations where the commander is unwilling to accept, across the board, hardly any correlation risk. However, other weaknesses about this approach to articulating criteria still make it less

than effective. Aviators agree that the term positive identification is unclear. The term is not defined nor elaborated upon in doctrine, policy, or tactics manuals. Historically, commanders have used it to mean different things. In DELIBERATE FORCE, positive ID meant essentially just that however, in DESERT STORM it implied a somewhat less restrictive criterion. Finally, airmen in tomorrow's air operations will undoubtedly execute their missions using sensors, avionics, weapons and tactics that are just not consistent with the positive ID paradigm. Commanders have a responsibility to provide ROE that fits within the framework of how they expect their subordinates to operate.

The correlation matrix paradigm is an effective approach to integrating air-to-ground target correlation criteria into a variety of combat air operations. Its principal merit is that it effectively translates the commander's intent for correlation risk that he is willing to accept into commensurate criteria for airmen to execute. In this way, it meets the JFACC's needs without being overly restrictive on airmen. Because the JFACC can use the matrix to communicate varying levels of correlation risk, it is applicable to operations with different political and military scenarios. The generic correlation matrix approach could become standardized across air operations. Then, commanders could use the options provided by each correlation category to communicate their acceptable correlation risk and the corresponding procedures that support that risk level. If required, commanders could also shape the details of each platform's categories to meet the particular needs of their operation. The situation in some operations might be such that the commander decides that all targets should fall into Category I. In this way, the resulting criteria would be somewhat similar to the positive ID approach. Other

operations, especially those resembling conventional warfare, would likely induce the JFACC to spread the various targets among Categories I through III.

Besides creating a process that allows the JFACC to vary the acceptable correlation risk, the matrix paradigm has other notable strengths. Having criteria specific to each delivery platform will help ensure that the criteria are both clear and executable. This is because the JFACC will need to enlist the help of subject matter experts to help draft respective matrices. The subject matter experts, by definition, will understand the capabilities and limitations that their fellow aviators must deal with in the air. Consequently, they will be able to help develop specific criteria that not only capture the commander's intent, but also fit clearly within the framework of how the airmen will execute their missions.

Despite compelling strengths that solidify its overall effectiveness, the correlation matrix paradigm does have some drawbacks. The most noteworthy one is that it is not necessarily easy for the commander and his staff. It is not easy because it takes work to ensure they develop effective matrices and supporting SPINS' notes. Furthermore, this approach compels the JFACC and his staff to conduct some sort of correlation risk analysis for each target--something that they likely have not done in the past. Finally, the ATO production team must ensure they annotate each ATO's targets with the correct correlation category. This hard work at the headquarters, however, should pay immediate dividends to those who execute the ATO and long-term dividends to the JFACC in meeting theater military objectives.

Recommendations

Several recommendations emerge from this study. Some involve changes to doctrine or policy. Other recommendations point out areas of the overall thesis topic that are ripe for further study.

One recommendation of this study, in order to help capture some of the conclusions presented in this thesis at an institutional level, is to update AFDD 2-1.3, *Counterland.* AFDD 2-1.3 needs to address air-to-ground target correlation criteria more directly than it does now. The document should include a short section on air-to-ground target correlation criteria. This section should begin by observing that the JFACC would normally be responsible for publishing air-to-ground target correlation criteria. It would be appropriate for AFDD 2-1.3 to acknowledge that technology has provided airmen effective means of ensuring that weapons land on the correct targets besides positively identifying it. Furthermore, this section should include the common attributes of effective criteria. Finally, it should point out that different targets may deserve different degrees of correlation risk, and that a set of criteria that takes this into account would enhance operations. It would not be appropriate to place more specific guidance, than that suggested above, into this broad a level of doctrine. For example, trying to codify the correlation matrix paradigm in this document would make it too inflexible. Since joint doctrine does not have a counterpart to AFDD 2-1.3, Joint Publication 3-56.1, *Command and Control of Joint Air Operations*, should include a similar section.

The author recommends teaching a short lesson on the correlation matrix paradigm at Maxwell Air Force Base's College of Aerospace Doctrine, Research, and Education. This school teaches a course to senior officers on how to be a JFACC. This

course is a perfect opportunity to educate commanders on the details of this approach. The two areas for further study addressed in the next paragraph should also be incorporated into the lesson plan.

How a JFACC can integrate with his staff to execute the processes outlined in this thesis is an area that deserves further study. The process does take work to execute, and there is merit in examining how the JFACC and his staff could do this effectively and efficiently. Another area worth examining is to take a closer look at how to conduct effective correlation risk analysis. The last section of the opening chapter touched on this subject, but it is worthy of more attention. One topic that a researcher could address under this area includes a historical analysis of the political ramifications of collateral damage incidents. Another section might look at the destructive effects of various weapons or their propensity to malfunction and what might happen when they do.

Lessons Learned

This section does not address lessons learned relating directly to the thesis topic, but rather two of the author's major lessons as they pertain to bringing this project to fruition. The goal here is to hopefully alert someone who might embark on a similar endeavor to the errors at least one student made, and what he would do different next time. There are too many pitfalls in the world to have to experience them all first-hand.

The next time, the author will not begin the end in mind. This was undoubtedly the greatest lesson of the project and one that caused the author the most consternation. Admittedly, the author began this thesis with an idea of what he thought the conclusions should be. This caused a constant temptation for the author to find research that supported his pre-disposed conclusions, rather than conduct purely open-minded research

and use deductive reasoning from there. To be candid, this paper contains elements of both approaches to the problem. In the end, though, the author stands by his conclusions and is aware that they are somewhat different than he thought they would be.

The next time, the author will build his survey so that it gathers data that directly relates to answering the primary or a subordinate question. Understandably, this lesson looks like the product of an immature researcher. A good learning point though, is to not begin to develop a survey instrument until one has the choice and wording of the primary and secondary questions well in hand. This author's subordinate questions went through several iterations, which in turn affected the usefulness of the survey data. It was also easy to get sidetracked by designing survey questions addressing points about which the author was curious to know the answer. The better survey questions were those that were specifically developed to provide concrete data points that supported answering the primary or subordinate research questions.

Summary

Effectively integrating air-to-ground correlation criteria into combat air operations is not a simple task. There are no panaceas that will provide the perfect solution all of the time. There appears to be much room for improvement, however, over the current approach to this challenge. The positive ID criterion, while having some limited usefulness, does not effectively serve the needs of both the commander and the airmen who execute an operation. The correlation matrix paradigm, on the other hand, provides an effective approach for integrating air-to-ground target correlation criteria across a variety of operations.

This thesis does provide a relatively explicit example of how a JFACC might incorporate a correlation criteria matrix into an operation. However, the author's intent is not to advocate the details of his examples, but to demonstrate that there ought to be a fundamental shift in commanders' approach as to how they think of and articulate air-to-ground ID criteria. Commanders need to have a process in place that recognizes that, when it comes to correlation risk, not all targets were created equal.

APPENDIX

SURVEY RESULTS

This appendix reports the raw data collected from the survey. The questionnaire contained fifteen questions. Twenty-two students and faculty from the United States Army's Command and General Staff College (CGSC) participated in the survey. Thirteen pilots from an operational F-16 squadron also completed the questionnaire. Each question listed below is verbatim to how it appeared on the questionnaire. The table immediately following each survey question reports the data gathered for that question only. The left most column represents the choice of available answers respondents had in answering the question. The next three columns to the right report the actual number of people who selected each possible answer. The table reports this data separately for each of the two population groups, then also derives a total by combining the two into a whole. The three columns on the right translate the raw numbers into a percentage. The author rounded results to the nearest one percent. Not every respondent answered every question. In those instances, percentages are based only on the number of people who answered that particular question.

After the questions, the survey contained a place soliciting comments. Those comments are listed below in a separate subsection after question fifteen. In cases where a respondent directed a comment at a particular survey question, the author has included that comment with that specific question. The author has employed a footnote technique within the table results to direct the reader to the comment. The author has taken some license with reporting comments. He has deleted comments that were either of a personal nature or not germane to the project. He has also paraphrased or added words where

appropriate so that a comment will be more understandable to the reader. In these instances, he has annotated that with brackets. Also, he has attempted to not change the substance of any comment.

Questionnaire Results

1. I have flown/crewed air-to-ground missions.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
YES	22	13	35	100%	100%	100%
NO	0	0	0	0%	0%	0%

2. I have flown air-to-ground missions in support of a real-world contingency.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
YES	17	13	30	77%	100%	86%
NO	5	0	5	23%	0%	14%

3. I have dropped air to ground munitions in a combat environment.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
YES	9	4	13	41%	31%	37%
NO	13	9	22	59%	69%	63%

4. Within the last 5 years, how often have the Rules of Engagement (ROE) or Special Instructions for exercises and/or real-world operations, in which you have been involved, addressed air-to-ground target ID criteria.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Greater than 75%	5	3	8	23%	23%	23%
51-75%	3	4	7	19%	31%	20%
25-50%	4	4	8	18%	31%	23%
Less than 25%	6	2	8	27%	15%	23%
N/A	4	0	4	18%	0%	11%

5. Within the last 5 years, air-to ground target ID criteria provided by the tasking commander (who published the ATO) for exercises and/or real-world operations has been effective.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Greater than 75%	3	2	5	14%	17%	15%
51-75%	8	5	13	36%	42%	38%
25-50%	2	1	3	9%	8%	9%
Less than 25%	3	4	7	14%	33%	21%
N/A	6	0	6	27%	0%	18%

* 1 F-16 pilot did not answer this question

6. At the last operational unit I served in, specific criteria for target ID requirements were briefed for each air-to-ground tactics mission.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Greater than 75%	9[a]	1	10	41%	8%	29%
51-75%	4	4	8	18%	31%	23%
25-50%	1	2	3	5%	15%	8%
Less than 25%	7	4	11	32%	31%	31%
N/A	1	2	3	5%	15%	8%

[a]Comment: Satellite imagery of radar OAP [offset aimpoint]

7. **"Pilots/aircrew will positively identify the target prior to weapons release."** This statement is representative of air-to-ground ID criteria I have experienced in exercises and real-world operations.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	7	3	10	32%	23%	29%
Agree	11	8	19	50%	62%	54%
Neutral	1	1	2	5%	8%	6%
Disagree	3	1	4	14%	8%	11%
Strongly Disagree	0	0	0	0%	0%	0%
N/A [Not Applicable]	0	0	0	0%	0%	0%

8. **"Pilots/aircrew will positively identify the target prior to weapons release."** This air-to-ground ID criterion is clear and executable.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	3	0	3	14%	0%	9%
Agree	3	5	8	14%	38%	23%
Neutral	5	3	8	23%	23%	23%
Disagree	9[a]	5	14	41%	38%	40%
Strongly Disagree	2	0	2	9%	0%	6%
N/A [Not Applicable]	0	0	0	0%	0%	0%

[a]Comment: Subjective!

9. **"Pilots/aircrew will positively identify the target prior to weapons release."** This air-to-ground ID criterion places severe restraints on pilots/aircrew.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	2	2	4	9%	15%	11%
Agree	6	5	11	27%	38%	31%
Neutral	5	2	7	23%	15%	20%
Disagree	8	3	11	36%	23%	31%
Strongly Disagree	1	1	2	5%	8%	6%
N/A [Not Applicable]	0	0	0	0%	0%	0%

10. **"Pilots/aircrew will positively identify the target prior to weapons release."** This air-to-ground ID criterion is consistent with current/pending munitions and tactics.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	0	0	0	0%	0%	0%
Agree	2	1	3	9%	8%	9%
Neutral	4[a]	3	7	18%	23%	20%
Disagree	13	6	19	59%	46%	54%
Strongly Disagree	3	3	6	14%	23%	17%
N/A [Not Applicable]	0	0	0	0%	0%	0%

[a]Comment: Does not matter

11. There are circumstances when it might be operationally sound to drop an air-to-ground munition without identifying the target in the air. (Assume this is not an ROE violation when answering this question).

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	8	5[c]	13	36%	38%	37%
Agree	11[a]	8	19	50%	62%	54%
Neutral	2	0	2	9%	0%	6%
Disagree	1[b]	0	1	5%	0%	3%
Strongly Disagree	0	0	0	0%	0%	0%
N/A [Not Applicable]	0	0	0	0%	0%	0%

[a]Comment: Joint Defense Attack Munition [JDAM]- Global Positioning System [GPS] coordinate bombing.

[b]Comment: What if it is friendly, or a hospital or something?

[c]Comment: How are we going to ID targets and/or confirm target coordinates are correct with GPS aided/guided weapons?

12. Minimum requirements for target ID should be specific for a given target and mission.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	6	8	14	27%	67%	41%
Agree	13[a]	3	16	59%	25%	47%
Neutral	0	1	1	0%	8%	3%
Disagree	2	0	2	9%	0%	6%
Strongly Disagree	1	0	1	5%	0%	3%
N/A [Not Applicable]	0	0	0	0%	0%	0%

* One F-16 pilot did not answer this question

[a]Comment: These are definitely given on "special" sorties (i.e. nuclear verification lines)

13. For a given operation, who should **primarily** be responsible for developing minimum requirements for air-to-ground target ID?

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq	Total	CGSC	F-16 Sq	Total
Joint Force Commander	2	1	3	10%	8%	9%
Joint Force Air Component Commander (responsible for the ATO)	9[c]	8	17	43%	67%	52%
Tasked Unit Commander	3	0	3	14%	0%	9%
Mission Commander	4[a,b]	2	6	19%	17%	18%
Flight Lead	1[d]	1	2	5%	8%	6%
Individual Pilot/Crew	1	0	1	5%	0%	3%
Other**	1	0	1	10%	0%	3%

* One CGSC member and one F16 squadron pilot did not answer this question
** Other: 1) Air Operations Center personnel, weapons system specific

[a] Comment: If a Forward Air Controller [FAC] is present, he should be primary

[b] Comment: [Mission commander decides] with Joint Force Commander and joint targeting cell guidance based upon tasked weapon system

[c] Comment: The Joint Force Air Component Commander [JFACC] should do big picture and the tasked unit commander should refine for [specific weapons systems], or give input to the JFACC

[d] Comment: Based on guidance from above

For questions 14 and 15, consider the following concept for communicating target ID criteria. Note: Tasking commander refers to the commander who publishes the ATO, such as the JFACC.

Within the ROE/SPINS section of the ATO there is an air-to-ground target ID criteria matrix specific to each air-to-ground weapons system involved in the operation. The matrix divides targets into three categories with Category I targets requiring the most stringent ID criteria and Category III targets requiring the least stringent ID requirements. Each offensive counter air, interdiction and strategic attack target in the Daily ATO is then assigned a target ID category at the tasking commander's discretion. Target categories are assigned on factors such as collateral damage potential, mission priority, military and political objectives, and target characteristics.

14. This type of method would be an effective way of communicating the target ID requirements from the tasking commander to the pilot/aircrew who executes the mission.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	5	0	5	24%	0%	16%
Agree	10	11	21	48%	100%	66%
Neutral	4	0	4	19%	0%	13%
Disagree	1[a]	0	1	5%	0%	3%
Strongly Disagree	1	0	1	5%	0%	3%
N/A [Not Applicable]	0	0	0	0%	0%	0%

* One CGSC member and two F-16 squadron pilots did not answer this question

[a] Comment: I think this type of guidance is too general still. Mission commander or flight commander should use this general basis for formulating specific criteria for crews/pilots. It is a good concept, but needs a middle man to make it effective

15. This type of method would impose too many restraints on pilots/aircrew.

	Number of Respondents			Percent of Respondents		
	CGSC	F-16 Sq.	Total	CGSC	F-16 Sq.	Total
Strongly Agree	1	0	1	5%	0%	3%
Agree	3	0	3	16%	0%	9%
Neutral	4	3	7	16%	27%	22%
Disagree	10	7	17	47%	64%	53%
Strongly Disagree	3	1	4	16%	9%	13%
N/A [Not Applicable]	0	0	0	0%	0%	0%

* One CGSC member and two F-16 squadron pilots did not answer this question

Survey Comments

1. It is important to note that the mission commander and the individual pilots employing weapons on targets are best suited to determine how and whether a target can be positively identified not the ATO. There must be dialogue about how best to ID targets, and to what extent, between the bomb droppers and the ATO writers.

2. With target ID being affected by so many factors, you have your work cut out for you trying to roll it up into three categories. How will your work address dropping

on a ground FAC's direction (often in close proximity to friendlies) where the pilot drops on a target he cannot see (troops in a treeline?) and must trust the FAC when he says "cleared hot"?

3. Some of your category characteristics or factors are a function of munition selection, not target type.

4. Good job stating matrices specific to [weapons system] delivery/ targeting systems.

5. This is ROE, not specific mission tasking. If it is truly going to be ROE, it has to be easily executable across a wide range of targets and be able to be applied rapidly on the fly during a mission. It is the basis for the aircrew to exercise sound judgment based on the situation. It must not degenerate into something cumbersome. It must be one with the other ROE . . . air-to-air, self-defense, etc.

6. [This comment is in reference to the respondent answering "agree" to both questions 14 and 15.] I know this seems contradictory. Here's my logic. I like the fact that "factors" are being included in target categories, so it is, by definition, more informative and represents "a way" of communicating. But . . . the ATO is already thick enough. This information would be better off in a target folder and (we've all seen this) anytime you make a fancy matrix or codify "good judgment" any hope of pilot judgment is gone forever.

7. In the F-15E we usually brief a target offset game plan as well as a plan to map the target direct. The goal out of all this is to get the targeting pod cued to the target, which is where the "positive" ID takes place. GPS aided munitions will probably change

this, but I'd imagine you'll still have to insure GPS cueing matches on board cueing in a "collateral damage" environment.

8. In my experience, positive ID of nearest friendlies was most critical. Today we are more concerned about precision bombing and limiting collateral damage, but also moving to stand-off deliveries with intelligent munitions. The crew may never "see" the target to ID it if other than radar or visual delivery. E.g., GPS delivery in weather or at night (F-16 or F-15E) or Joint Defense Attack Munition standoff deliveries from B-1 or B-2. How do we define positive target ID? The JFACC needs to set minimum requirements based on Joint Force Commander guidance. Your matrix may be a good idea as long as it's broad enough, i.e. not to detailed/complicated. Aircrews always need the flexibility to ensure decentralized execution.

9. For questions #14/15, are you thinking about beyond visual range type criteria? The pilot is still responsible

10. Cannot answer 14 and 15 without seeing Category I, II, and III words

11. Positive "ID" is not clear when the pilot has multiple sensors... [radar, infrared, visual]. Pinpoint target requires different ID than large target. Equally important, can I lase a laser-guided bomb to impact. Should be specified/included as part of air-to-ground criteria for <u>some</u> targets.

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